NOVEMBER 4, 1957 PRICE 50 CENTS

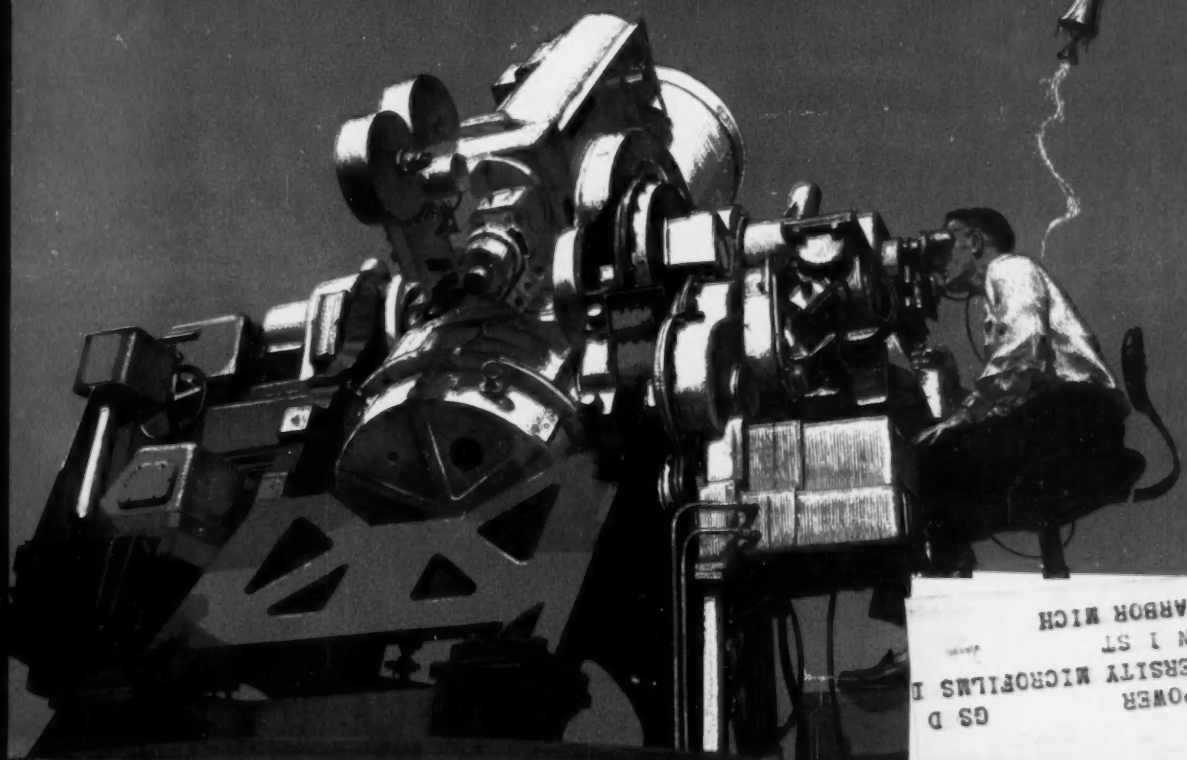
Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN
RESEARCH AND DEVELOPMENT

Research AND Development EDITION

Trends in New Car Appearance . . .
see page 30

Design to follow a star . . .
see page 21



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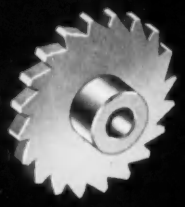

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Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

November 4, 1957 Vol. 28, No. 18

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Product Engineering ..... SIDELIGHTS

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● **The machine designer** is now defined as a sort of corporate body consisting of many contributors (see page 33). A recent communication from the West Coast seems to support this thesis. An aircraft designer lifted the cover of his drafting board one Monday morning to discover the following note penciled on cardboard and clipped to his drawing. "Dear Sir: You spelled the second 'detail' wrong.—Your Janitor."

● **Computer terminology** has become so complex that descriptions of units read almost like a foreign language. (Note the careful avoidance of this terminology on page 36). Individually the words make sense; collectively they tend to destroy any vestige of engineering self-confidence a man may have. One executive, in a desperate attempt at understanding, asked an IBM representative, "In simple words please, what is the real difference between the 704 and the 650?" The representative replied, "Well, the best I can say is that the 704 thinks the 650 is a moron."

● **Engineering economy** has been much touted by Detroit car manufacturers recently (see page 30) and a few humbling figures may be in order here. Gasoline costs about 1.8¢/mile and oil about 0.5¢/mile for a total of 2.3¢/mile, assuming your car is in reasonably good shape and you intend to keep it that way. A horse can travel about 30 miles on oats and hay costing 60¢, or about 2¢/mile. A horse will last 10 years—first cost about $300.

Are you still in a hurry?

● **Sputnik** started as many heated discussions among our editors as it probably did in every engineering office around the world. Our science fiction addicts took it calmly—spouting statistics and formulas to prove, for example, that a satellite must speed up as it loses altitude, and that it loses altitude because air resistance slows it down. The contradiction here didn't bother them a bit and they were nearly laughed out of the office—until recent scientific reports indicated that Sputnik *is* speeding up and losing altitude as well. *Astounding Science Fiction* and *Galaxy* have just acquired 12 new (shamefaced) readers.

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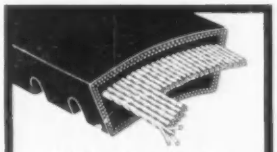

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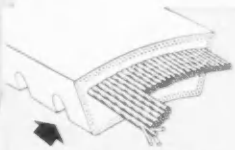

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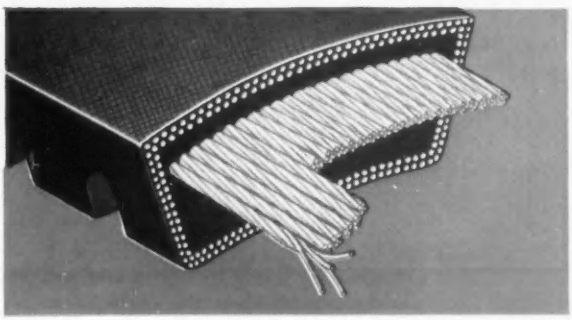

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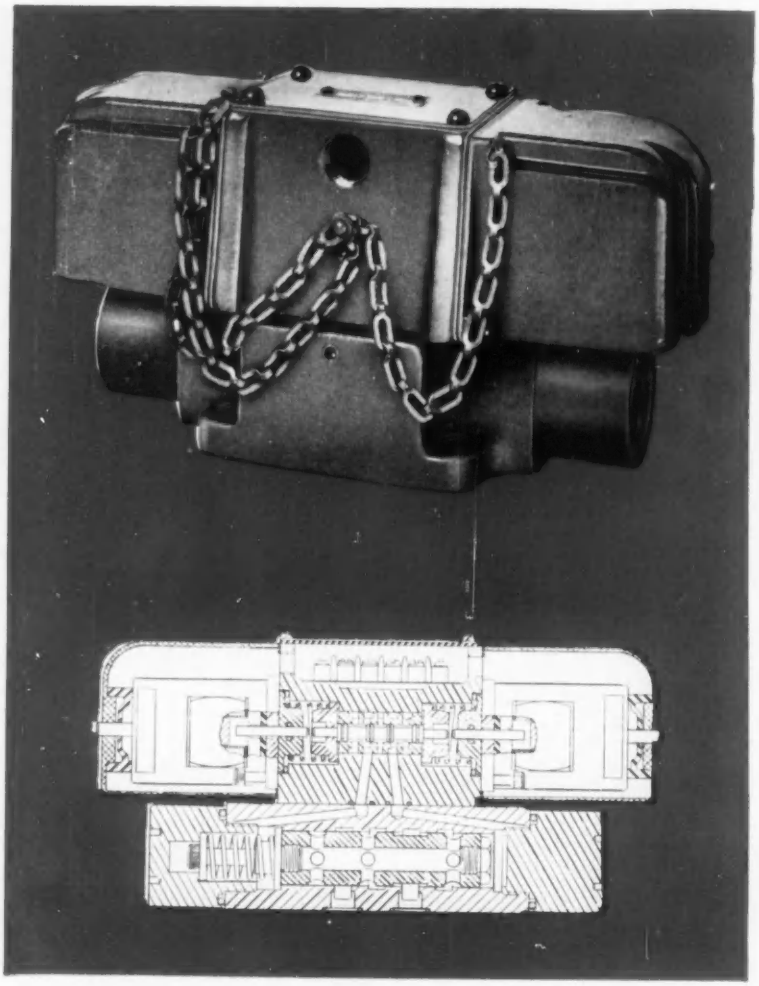

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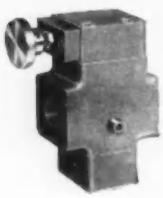

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DEVELOPMENTS TO WATCH...

Glass flakes control light, stop corrosion . . .

. . . and provide electrical insulation in a new series of materials now being readied by Owens-Corning Fiberglas Corp.'s research labs. The materials—all made by combining near-microscopic glass flakes with transparent thermosetting resins (polyesters, epoxies)—have remarkable properties.

One group of glass-flake laminates, used for light shields, for instance, is so effective in providing polarized, glare-free lighting that OCF development engineers predict it may even replace present-day lens systems in such applications as sealed-beam headlights—and at far lower cost. Light transmission is unusually high too—65 to 70%.

Another group has a high enough dielectric strength (1000 volts or more per mil) to rate consideration as a replacement for mica and porcelain insulators.

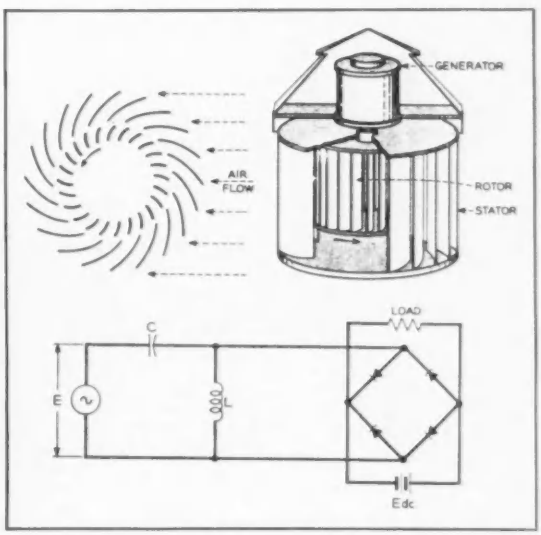
Most exciting immediate possibility may be coatings for corrosion-prevention. The high glass content possible (80 to 85%) can provide a protective, vapor-resistant layer with a single coating, OCF says, where two or three coats must now be used.

High glass content has an added advantage: Structural panels combining glass flake with glass cloth can be made far more rigid than glass fiber or cloth alone—so much stronger that OCF thinks the combination may even eliminate need for honeycomb coring in some applications.

Bell Labs is tilting with windmills . . .

. . . and for good reason. Miniature windmills that provide driving torque for a current-generating rotor are among several novel power sources being tested for use with new transistorized devices. As Bell Labs points out, many such devices require far less power than previous designs. One example is a relay for rural carrier systems. It needs only about one watt of power, but this must be supplied in regions often remote from commercial lines—hence the windmill idea. As W. A. Marrison of the Bell Labs Transmission Research section points out, the total power contained in the wind at sea level is about 1w per sq ft at 6 mph, but it increases as the cube of the velocity, so that even a 15-mph wind provides as much as 15w. In the windmill pictured, the only moving part, the rotor, is mounted on a shaft to which also is attached a permanent-magnet generator, with moving magnet and stationary windings.

Baby windmill is under test at Bell Telephone Labs for rural carrier systems and other communications units requiring only small amounts of electrical power.



Windmill design is outlined above. Wind entering from any direction produces driving torque on both sides of rotor. Lower diagram shows the electrical circuit developed for use with it.

(continued)

DEVELOPMENTS TO WATCH...

A chemical bond between aluminum and copper . . .

. . . and strong joints between magnesium, brass, zinc, silver, titanium and gold as well.

That's the claim of Intertectics, Inc., Bedford, Ohio for its new bonding technique. The company describes its "InterAct" process as an ion-exchange system involving formation of "a reaction eutectic." This material, under influence of heat, eliminates the surface oxide layer and causes the metals to flow together at temperatures lower than the melting point of either metal being used.

Three bonding agents are now being readied for market: a combination of zinc, lithium, potassium and sodium chlorides encased in a zinc-aluminum alloy sheath; the same materials in powder form; and a granular mixture of aluminum trichloride with zinc and sodium chlorides. The rod is priced at $6 a lb.; powder and granules at $5.10 and $5.75 respectively. The last two forms are hygroscopic, and come sealed in polyethylene bags; shelf life is said to be indefinite, if the seal is not broken. Joining can be done with gas torch, conveyorized induction furnace, or electric strip heating; and Intertectic's executive vice-president, Harold M. Gruener, says no precleaning or other special treatment is needed. Reaction temperature is approximately 810 F. A water wash removes the welding by products.

Another kind of transistor . . .

. . . this one claimed to be a "marked advance over both vacuum tubes and existing transistor switching devices because of its combination of simplicity, speed, and extremely low power requirements," is under development by RCA researchers.

As a bi-stable switching element, the new device can "switch substantial currents from one circuit to another in periods as short as one fifty-millionth of a second," and can switch from "off" to "on" and vice-versa simply by applying low-energy pulses to the base circuit. It will also work as a conventional high-frequency transistor in amplifying circuits. Sustaining voltage is "on the order of ½ v at 100 milliamp," and in the "off" position, it conducts as little as 2 microamps. RCA calls it a "Thyristor," describes it as "a modified germanium junction-alloy transistor with a new type of collector contact." It is fabricated by ordinary diffusion and alloy techniques. No plans have yet been announced for commercial production.

Will molded plastics and hardboard replace . . .

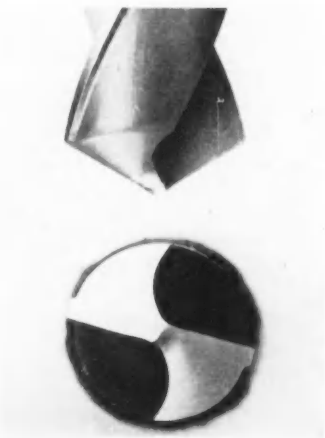
. . . the fabrics so long used for automotive headlinings? There's at least a chance they will—and the reasons why are important.

Last year, in its Suburban models, Plymouth used a vacuum-molded plastic headlining—total weight barely 10 lb. Its neat appearance and ease of cleaning made a hit with customers; simplicity of installation made a hit with production departments. This year, with a lower, flatter roof line, a more-rigid headlining was needed. Plymouth turned to hardboard and Masonite, coated with plastic enamel, and held in place by metallized plastic strips. This time, the over-all unit cost is higher than that for a fabric lining; but, says Plymouth, "our engineers feel the advantages it offers make it well worth the added unit cost.

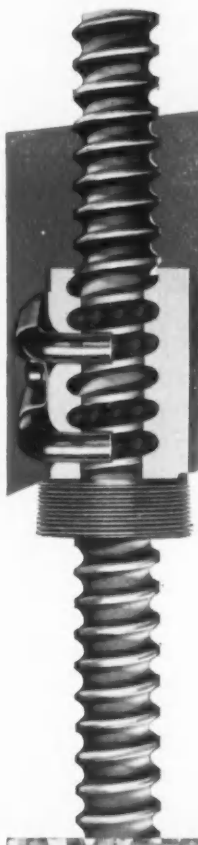
A.R.G.

Truer holes . . .

. . . that are rounder, straighter, closer to size—are promised by a new drill point now under test at Cincinnati Milling Machine Co. Called the "sipral point," it has a reduced negative rake angle (see photo) and an improved clearance angle to facilitate cutting action. It is said to be self-centering and to exhibit no tendency to "walk" to one side or other of the desired hole location the company has designed a special grinder to produce these drills, with an adjustable truing device so that the point angle may be varied from 90° to 180°.



New concept in drill-point design is spiral point, viewed here from side and bottom. Advantages over chisel-point drills: sharper tip, reduced negative rake.



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SAGINAW b/b SCREWS

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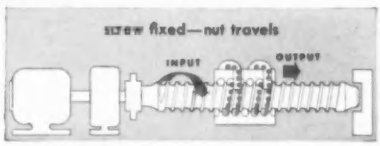
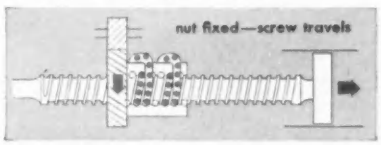


FORWARD: When rotary motion is applied to the screw, the b/b nut is driven along the axis of the screw, changing rotary motion to linear motion.



FORWARD: When rotary motion is applied to the b/b nut, the screw is driven along its longitudinal axis, changing rotary motion to linear motion.

1 **POWER SAVINGS.** Operating with over 90% efficiency, Saginaw b/b Screws permit much smaller motors with far less drain on electrical systems, and also simplify circuitry.

2 **SPACE SAVINGS.** Saginaw b/b Screws themselves are compact. They permit smaller motors and gear boxes and eliminate auxiliary equipment required by hydraulics.

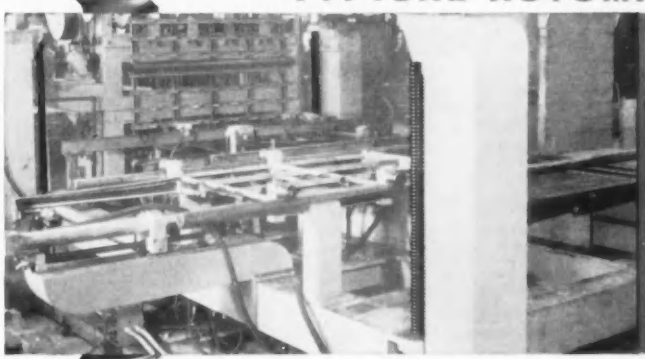
3 **DEPENDABLE PERFORMANCE.** Saginaw b/b Screws are far more reliable than hydraulics or pneumatics. Gothic-arch grooves, yoke deflectors and multiple circuits provide added assurance.

4 **PRECISE POSITIONING.** Saginaw b/b Screws will position components far more precisely than hydraulics or pneumatics; tolerances on position are held within .0006 in./ft. of travel.

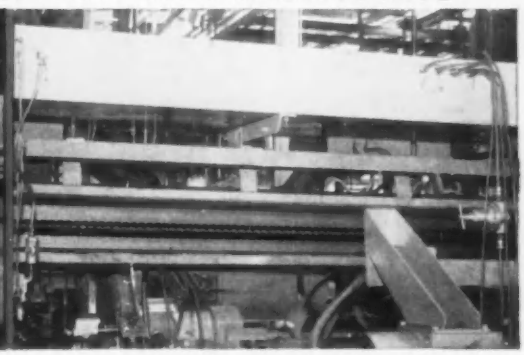
5 **TEMPERATURE TOLERANCE.** Normal operating temperature for Saginaw b/b Screws is from −75°F. to +275°F. But in selected materials, they will function efficiently at temperatures as high as +900°F.

6 **LUBRICATION.** If lubrication fails the Saginaw b/b Screw will still function with remarkable efficiency. Units have been built and qualified for operation without lubrication.

TYPICAL AUTOMATION APPLICATIONS



Automatic indexing device for stacking material. Saginaw b/b Screw used to raise and lower table.



Automatic device for loading and unloading machine. Saginaw b/b Screw used to save power and space.

If you would like further details on the use of Saginaw b/b Screws to increase the efficiency of plant operations, or specific application recommendations for your individual processes, experienced Saginaw engineers are at your service without obligation. Just write or phone us your requirements, or fill in and mail the handy coupon below.

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TECHNIQUES and DEVELOPMENTS in oscillographic recording

FROM

SANBORN

CIRCUIT DESIGN AND TYPICAL USES OF THE "150" CARRIER PREAMPLIFIER

One of the most frequently used plug-in front ends for Sanborn 150 Series oscillographic recording systems is the Model 150-1100 Carrier Preamplifier, since with it a "150" system can record such variables as force, temperature, strain, pressure, displacement, velocity, flow, acceleration — or any variable which can be expressed as a suitable input signal by a transducer. The "1100 Carrier" will operate with a variety of different transducers and bridge circuits, which will be mentioned later on.

In the block diagram (Fig. 1), a push-pull oscillator provides an excitation voltage of about 5 v. to the transducer at a standard frequency of 2,400 cycles or optional frequencies of 600 and 1,200 cycles, using plug-in components. This excitation voltage also feeds the Balancing, Calibration and Zero Suppression circuits. (The Balancing controls allow correction of resistive and reactive signal leakage from the transducer, so that at zero load the net signal to the Preamplifier is zero. The Zero Suppression feature permits bucking out a large static load so that a small part of the load can be expanded over the full recording chart. The Gage Factor control allows the zero suppression range to be made equivalent to some convenient transducer load, or the full load rating of the transducer, and also causes the calibration signal to represent 2% of that load.) Transducer output is fed to the transformer through the Gage Factor potentiometer, across which the Balancing-Calibration-Zero Suppression circuits develop a voltage effectively in series with the transducer output. The mixer receives a suppressed carrier AM signal and re-inserts a carrier component, to make its output a conventional AM signal whose modulation represents the transducer load. The modulation signal (whose amplitude and polarity represent magnitude and direction of transducer output) is recovered by the demodulator and fed to the output amplifier, which in turn excites the Driver Amplifier and recording galvanometer of a "150" system.

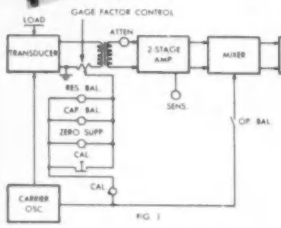

FIG. 1

Transducers which may be used with the Carrier Preamplifier include strain gage half-bridges or full-bridges, commercial resistance or reactance bridges, differential transformers and resistance thermometer bridges. The transducer chosen should provide at least 18.0 microvolts per volt of excitation at the minimum load to be recorded, for a one cm. deflection; impedance should be 100 to 1000 ohms. With strain gages, normal operation provides sensitivities of 50, 20 or 10 micro-inches per inch for each cm. on the recording, depending on the number of active gages. With resistance thermometers, if 1°C. or 2°F. per cm. stylus deflection is sufficient sensitivity, the user can construct his own resistance thermometer by including a 3 ohm coil of copper wire in one arm of an equal arm 100 ohm bridge.

Helpful information about the use of transducers with the 150-1100 Preamplifier is contained in the following Sanborn RIGHT ANGLE articles (reprints on request): Coupling Differential Transformers, Aug. and Nov. 1956; Filter Networks for use with Force Dynamometers, Nov. 1956; Calibration with 1-, 2- or ¼-arm Strain Gage Bridges, Aug. 1955; Theoretical and Actual Applications of Bridge Circuits, May and Aug. 1954.

Wing flutter recording to infrared research . . . with the versatile "1100 Carrier"

Today, Carrier Preamp-equipped Sanborn "150" systems are being used for frequency response tests of process control system components; to record shaft deflections of fluid mixing equipment; in infrared research . . . vehicular traffic studies . . . submarine hull vibration measurements. Applications are limited only by the transducers available.

These are applications of only one "150" front-end; eleven more interchangeable, plug-in Preamplifiers increase the scope of Sanborn oscillographic recording systems to meet an almost infinite variety of research, production and field testing requirements. All Sanborn "150" direct writing systems record inkless traces in true rectangular coordinates; all provide 1% linearity; Basic Assemblies — equipped with your choice of Preamps — are available from one- to eight-channels, packaged in vertical cabinets, portable cases, or specially modified housings.

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DEVELOPMENTS TO WATCH...

Speed-up orders to missile contractors . . .

. . . are scheduled, White House and Pentagon talk to the contrary. The administration claims that there is no missile or satellite race. But, none-the-less, indications are that the U.S. is trying for a "spectacular" in order to regain lost prestige.

One concrete example is the Air Force's Operation Farside. This project is designed to launch rockets from balloons at altitudes of around 100,000 feet. The goal is to get data on cosmic rays, the earth's magnetic field, and other areas of interest.

Test launchings for Farside were scheduled before the Russians launched their satellite. But, conditions had not been favorable for the tests. Then, when Sputnik was put into orbit and worldwide acclaim went to the Russians on scientific advancement, the administration tried to force its Farside experiment to take the spotlight off of Sputnik.

Result has been a blooper. Scientists on the project wanted to wait for optimum conditions, but they were forced to try anyway. And, four of six launchings have failed.

It may be the same story on the satellite program, too. The whole program is running four to six months behind the original schedule. Now, the President has publicly announced that the first attempt to put up a test satellite will come in December, the first instrumented satellite next March.

But, right now, a preliminary test firing is way over due. Three weeks ago, the Navy announced that a firing would be made "within a few days" to test the first stage rocket and instruments.

If the U.S. fails to keep its schedule, it loses another propaganda round. But, to meet the schedule seems sure to mean shortcuts, test firing before the vehicle is ready. End result could still be a dud.

But, the Navy is trying to meet the December date. So component-part manufacturers are being called on to deliver early.

Missile materials study . . .

. . . soon will be forthcoming from the Pentagon. Requested about a year ago, it is a criterion for selecting materials for missiles. Due to be completed in about a month, it should be helpful to designers. At one point, research facilities doing the work said that they couldn't make "rhyme or reason" out of the way materials are presently being selected in missile production.

One reason behind the Pentagon request is to see if titanium can be spread in the missile program.

Look for more metal price drops . . .

. . . aluminum may join copper, lead and zinc in sliding downward. There is a growing trend in the government toward the belief that the days of defense stockpiling and fast tax writeoffs are over.

Now, the shift is to make the metal industry—particularly non-ferrous producers—meet world competition unaided by government props. It is coming in the face of pressure to keep stockpiling practices and tariff protection. But, defense and other government agencies are cool to industry pleas. It is all part of the spending review, a general shift away from government supports.

Limitations on industry, use of nuclear materials . . .

. . . is slowing product development. Recently, the Atomic Energy Commission blocked the commercial use of "special nuclear material"—in this case, plutonium-beryllium neutron sources—by McCullough Tool Co. of Los Angeles for oil-well logging-operations. McCullough wanted to use the material commercially and to export it to Canada. But, AEC is required to limit use of the nuclear materials to research and development work. And, it is the sole importer and exporter of the materials in question.

There is a difference between "special nuclear materials" and byproducts. For example, McCullough could use polonium-beryllium, but it has drawbacks that plutonium-beryllium didn't have.

AEC has gone to Congress to have the restrictions lifted, but so far, has not been successful. Pressure is on for it to go back next year, and hopes are that Congress will ease the ban.

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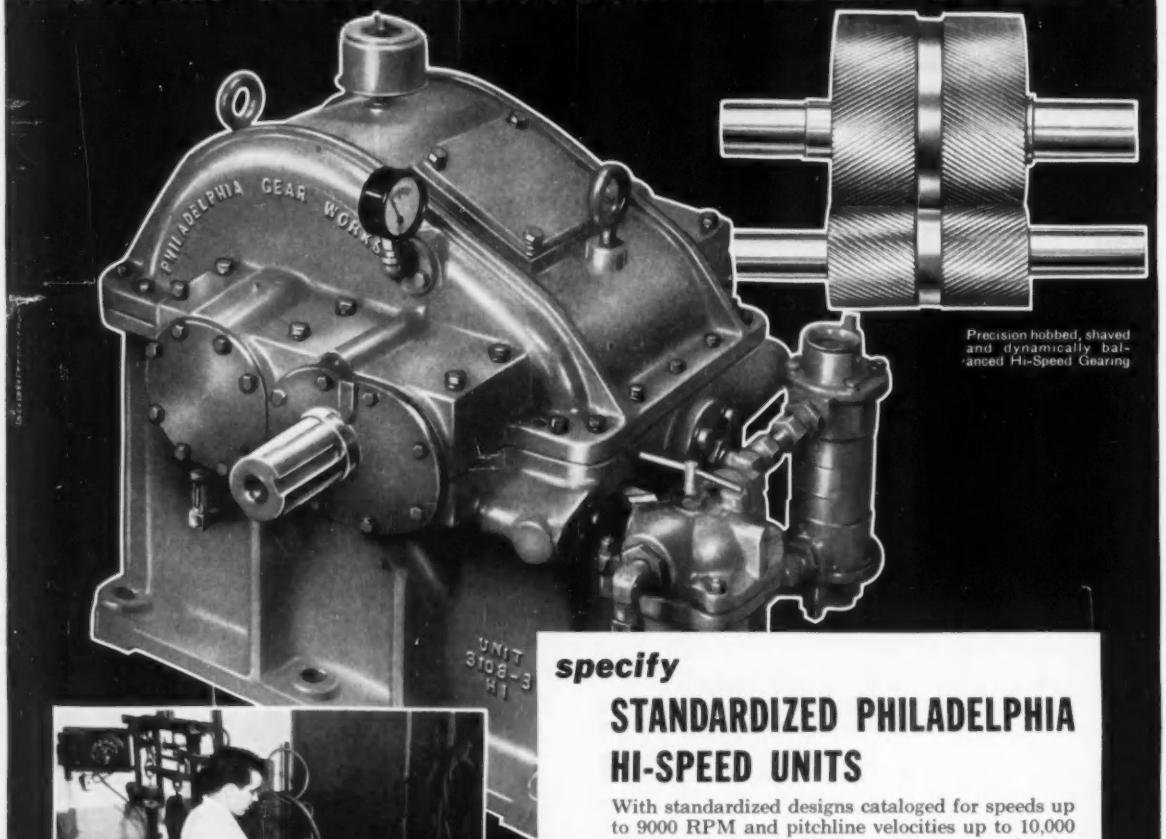

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DEVELOPMENTS TO WATCH...

Diamonds as semiconductors? . . .

. . . This is a real possibility, the South African Diamond Research Laboratory believes. Carbon is, of course, one of the elements known to have semiconducting properties, and the lab has confirmed that at least one type of diamond crystal (IIb) is definitely a semiconductor. The problem: how to make it a better one, and to give other types the same properties. One possible solution: irradiation, in a nuclear reactor or by high-energy machines, treatment already known to affect diamond properties.

All-electronic telephone exchange . . .

. . . an internal, private-branch system, is going into operation in England, and hopes for it are running high. The British Information Services says this "dream exchange" is noiseless, has no moving parts to go wrong, and will last "up to 50 years." The complete unit is contained in a box only 20½ in. long, 19 in. high and 12 in. deep. But into that box are crammed more than 1,000 components, including 74 electronic tubes of a "revolutionary new type that completely eliminates moving switches," and a "memory" that holds an incoming call until its line is free, then puts it through.

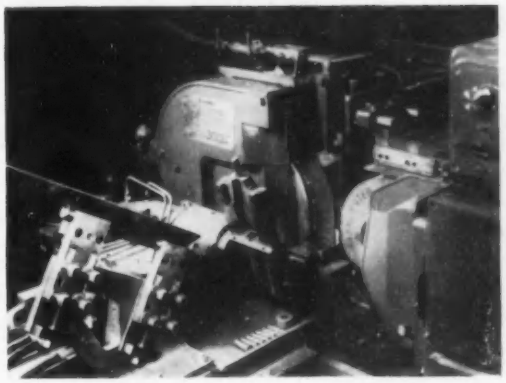
New coatings for steel and aluminum . . .

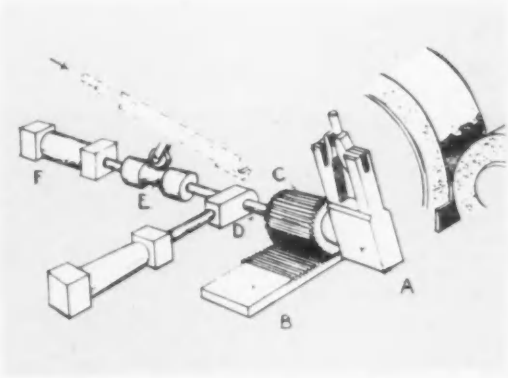
. . . announced by German firms, seem basically similar to compounds already available here, but could have advantages for specific applications.

Schering A. G., Berlin, says a brief dip (20 sec to 3 min) in its Tridur Al coating solution produces a corrosion-preventing layer on aluminum that "stands 3000 hr of hydrochloric acid spray-mist treatment, yet makes no change in part dimensions; hardness, or tensile strength." It also serves as an excellent ground for dyes. Electrical properties are not changed.

The other new coating is a three-part treatment, designed to "stabilize rust" and prevent further attack. Developed by Otto Loewe of Elmshorn, it's called Corrolit and is applied by brush or spray—two protective layers first, then a colored cover layer. Only a rough cleaning—not complete rust removal—is required before painting. The coating is said to dry in 3 hr and to resist even moist, humid climates.

New automatic pickup . . .





Automatic transfer-finger, devised by Arthur Scrivener Ltd., Birmingham, Eng., for a controlled-cycle centerless grinder, picks up parts one at a time from tray or chute and places them in throat of machine. Scrivener says jaws are easily changed to accommodate pieces of widely varying size and shape. A spring-loaded finger assembly (A) picks up the part from a hopper-fed work chute; and, under control of rack (B) and pinion (C) swings it over to the work place. Then piston (F) and push-rod (D) open the fingers while cam (E) actuates limit switch to start machine. Fingers now swing back to pick up next piece. The complete cycle can be accomplished in about 10 sec.

What's happening in SCIENCE

New machines for the fusion age

Know what a Columbus machine is? A Perhapsatron? A Stellerator. Are you familiar with Zeta?

If so, your nuclear engineering vocabulary is right up to date. None of these are defined even in the new ASME-ASTM glossary of terms, but they're mighty important in the development of controlled fusion (thermonuclear) power.

All four are basically tubes in which gases can be heated to temperatures far above those normally encountered on earth—a million degrees or more—and subjected to electro-magnetic forces in hopes of making an energy-releasing fusion reaction take place.

Columbus is the simplest, just a straight, cylindrical tube in which a hot gas, plasma (Oct. 7, p. 15) is controlled by a magnetic field to produce a "pinch effect" that will keep it away from the container walls and create a unidirectional current.

Perhapsatron and Zeta are circular tubes in which it's possible to stabilize the pinch effect for longer periods (the Columbus machine is useful only for very short-duration studies, on the order of five microsec or less), and produce higher temperatures—those at which fusion may actually occur. It was in Zeta that British scientists are believed to have achieved their first, momentary, controlled thermonuclear reaction a few weeks ago, reports of which set off a rash of predictions about fusion power. (Oct. 21, p. 12.)

Stellerator is still in the engineering stage; but if construction and authorizations proceed as planned, it should be in operation—at Princeton—late in 1960 or early in 1961. It will be similar to, but considerably larger and more powerful, than the Perhapsatron.

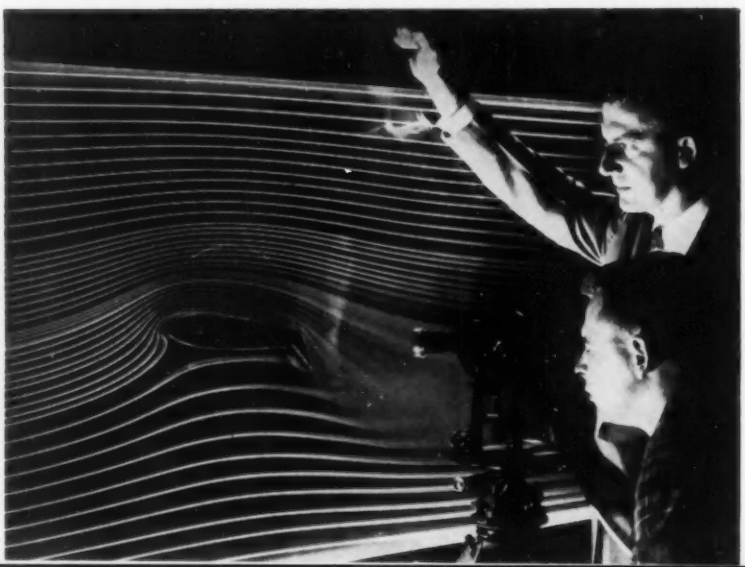
US sharpens its time standards

After five years of development, two types of "atomic clock" time standards, with a precision of one part in a billion, are now in the shakedown phase. They're getting full-scale, year-long tests and, says the Bureau of Standards, results look "very promising."

It will be a year or more before the new standards are adopted, and they won't affect most clocks and timing mechanisms (the present standard, based on the earth's rotation, is accurate to one part in a million). But the new standards are likely to be put to work—and right away—in radar, radio communications, and aerial navigation.

The two types are the "ammonia clock," based on vibrations of nitrogen atoms, and the "cesium clock," based on spin of cesium atoms. A.R.G.

New airfoil shapes are studied by engineers at Fairchild Aircraft Div. with help of an instrument borrowed from surveyors and astronomers—the transit. It's used to measure angles of deflection when slipstream passes over the wing. Under test here is the new "jet wing" design that eliminates conventional visible tail-pipe exhaust.



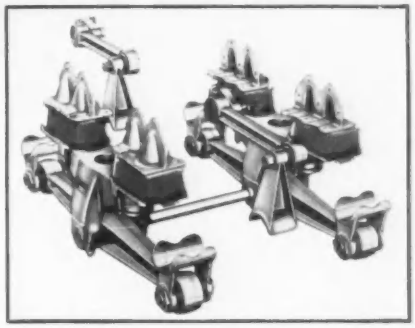
BRIEFS . . .

New meteorite theory, based on analysis of potassium-40 and argon-40 content by scientists at Argonne National Laboratory and Fermi Institute, says these astral fragments result from collisions between planets or asteroids, are relatively recent in origin (240-280 million years), though the asteroids may conceivably be as old as the earth, believed to have been formed about 4 billion years ago.

Ultramagnifier, designed to quadruple enlarging capacity of electron microscopes, is being made by RCA. It's primarily a new intermediate lens pole-piece which focuses the electron beam and makes it possible to enlarge to "well over one million times without deleterious grain effects." It fits standard EMU-3 machines, is available in an "install-it-yourself" kit for $500.

A completely stress-free condition can not be obtained in metals that contain more than one phase. That's the word from the National Bureau of Standards. It's based on new x-ray studies, resulting from recently developed technique. Research will be reported in detail in the Bureau's *Journal of Research*.

Fire-retardant coatings are still wide-open for research. The Air Force wants one that would hold temperature of the base metal to not more than 350 F while equipment is subjected to a flame temperature of 2000 F. The coating must also be lightweight, easy to apply, flexible, and resistant to water, aromatic fuels and lubricating oil. Most promising so far: boric acid, borax, and other low-temperature glass-forming materials, perhaps in combination with thermosetting resins as binders and foam vehicles.



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What's happening in MATERIALS

Silicon: more for less

Use of transistors, Aries Associates predicts, will increase 500% in the next few years. There's every reason to believe they're right, if recent developments in silicon can be taken as a gage.

For the fourth time in as many months, another new silicon producer has entered the field. This one, Silicon Crystals, Inc., Wilmington 99, Del., is producing semi-conductor-grade single crystals in dia of ¾ to 1¼ in., lengths to 5 in.

As supplies of this semiconductor metal rise, prices of fabricated components are coming down, and quality is moving up.

Texas Instruments, for instance, is price-cutting its silicon transistors by as much as 22%, and diodes about 35% (they now start at $2.10 in lots of 100 or more). At the same time, it is extending its warranty from 90 days to a full year.

Still plenty of bounce in natural rubber

Despite tremendous growth of synthetic rubber, and development of man-made "natural" rubber, you'll likely be specifying the tree-grown variety for some time to come.

Here are at least two good reasons: First, there just isn't enough synthetic rubber to go round—certainly not on a world-wide basis. The US produces—and uses—89% of the world's synthetic, says P. W. Litchfield, chairman of Goodyear Tire & Rubber Co., but this is only 63% of our total rubber consumption. And outside the US, ratio of natural to synthetic is 80 to 20.

Then, as the Natural Rubber Bureau points out, man-made "natural" is still not produced in quantity, and whether it can be competitively priced is questionable—particularly when "competitive" means not natural's 30¢ selling price, but the price at which it could sell under pressure of competition. NRB expects use percentage of truly natural rubber to increase rather than decrease over the next several years. New acreage of high-yielding stocks will also help to increase the supply and keep prices down over the next several years.

Columbium is looking for jobs

Columbium has great possibilities for high-temperature use—in aircraft, nuclear reactors, and electronic equipment. It's strong, lightweight, and ductile at elevated temperatures. And it's no longer in short supply.

R. P. Porter, president of Porter Bros. Corp., Boise, Idaho, told the American Mining Congress that producers of the metal now face a chicken-or-the-egg situation in which industry will not design columbium into high-temperature products because of its reputation for scarcity, and miners cannot produce it because of the negligible market.

It must also be noted that the metal is expensive. But new ore sources are helping solve the long-term supply problem. New processing facilities like Fansteel's big plant at Muskogee, Okla., are coming into play, and there is a good chance that prices will come down.

In many respects, columbium is similar to tantalum, with which it is often associated. It shows good resistance to nitric, tartaric and lactic acids and to sea water, but is attacked by strong alkalis. It resists oxidation in air to about 400 F, and can be used at much higher temperatures if properly protected, showing little loss of strength as the temperature rises.

Columbian—or niobium as it's officially been named—might be worth another look.

High-purity columbium produced by "cage zone melting" at Westinghouse, will help pin down optimum properties, pave way for new applications. Westinghouse expects metal to be especially useful for applications at temperatures above 1800 F; but protective coatings must be found.

BRIEFS . . .

High-tensile, weldable, ferritic stainless steel, being developed by United Steel Companies, Ltd., London, Eng., is expected to have "important aircraft applications." No details on composition or performance are as yet available.

Price range for cold-extruded molybdenum tubing produced by Hunter Douglas division of Bridgeport Brass (see Sept. 9, p. 29) is expected to be $40 to $80 a lb. As the company itself admits, "the only applications that at present justify use of this expensive seamless tubing are those requiring high strength at temperatures above 1200 F plus a high degree of corrosion resistance".

Investment castings now come with a guarantee—of tensile and yield strength and elongation—from Arwood Precision Casting. New casting methods, the company says, make it possible to set the following as minimum specifications: Tensile strength: 34,000 psi; yield 25,000 psi; elongation, 3%. On critical areas, even higher mechanicals can be obtained.

No stockpiling for nickel next year. The ODM announces that all nickel scheduled for shipment to the government in 1958—about 135 million lb—will again be diverted to industry. This should increase to 245 million pounds the amount of nickel available for nondefense use. Some of it is premium-priced metal, though.

Crane-of-all-work

THE ROUSTABOUT—manufactured by the Hughes-Keenan Corporation—is a highly versatile, highly maneuverable motive crane. It has an extremely short turning radius, travels at speeds up to 15 m.p.h. All three crane operations—swinging the boom, raising and lowering the boom, working the hoist line—can be performed simultaneously or independently. All six models (5 ton capacity shown) can be specially equipped for construction work, in-plant or out-plant materials handling. To assure maximum power efficiency and dependability, Roustabout Cranes are powered by big-output, heavy-duty Chrysler Industrial Engines.

CHRYSLER INDUSTRIAL 30

(230 cu. in. displacement) powers the 3, 4, 5, 6 ton models of the Roustabout Crane. (Industrial 32, 265 cu. in. displacement powers 10, 12½ ton models.) Both of these in-line six engines also power many other makes of equipment in the construction and materials handling fields. There are four Chrysler in-line 6s, two V-8s—ranging from 230 to 354 cu. in. displacement.

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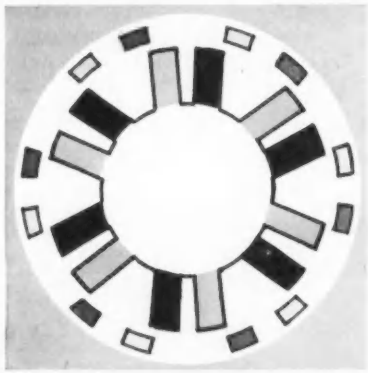

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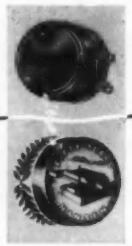

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1 MAN with an IDEA ... and TIME to THINK

This was the formula for successful research spelled out by the thousand small businessmen, educators and service representatives who met in Washington recently for the Presidents' Conference (Oct. 7, p25). And a very important formula it is, based upon bitter experience in these postwar years.

Time after time, during the three days of speeches, case studies and workshop sessions, it was reiterated that "the job that is everybody's is nobody's." Many small companies admitted fear of the word "research", of its cost, of its indefinite potential. But, again and again, it became crystal clear that research was never done . . . because it was the secondary responsibility of someone very busy with other work.

In large companies, the shift to committee direction and separate organization of research is almost universal (May '57, p. 133). The small company may have a committee of only one and an engineering department that isn't much larger. But, in either case, research is done only when someone has an idea and shoulders aside anything that interferes with it. Otherwise, the company slips . . . and falls.

Ours is an economy based on change. Nobody will buy a modern "one-hoss shay"—particularly because it will last "a hundred years and a day." We want the new, the different. Paradoxically, we pay a premium for the unique—as long as it isn't too different from what everyone else is buying.

More and more, this situation makes the small business the specialty producer, the alert and fast-shifting source of economical components. Big business becomes the assembler and marketer, so is literally forced into a broad research program. But little business is forced into research too, to preserve its traditional advantages of new ideas, alertness, fast footwork, skill, and low cost.

Thus the formula offered by the Conference. The number of men in research will vary with company size, but the principle cannot. There must be . . . somewhere in each progressive company . . . at least one somebody who has an idea, and who has been given the essential time to think.

K. Langeman

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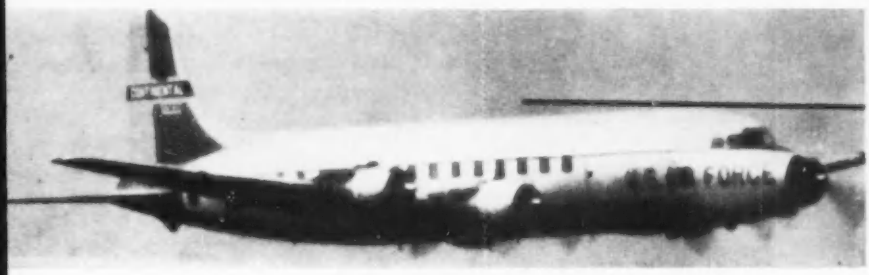
Keeping Track of Our Missiles



10 miles away but . . .

details of Air Force plane are visible thanks to ROTI Mark II. The instrument will give high-definition photo record of missiles winging out to sea.

MELBOURNE BEACH, FLA.—A photographic tracking system based on the most accurate instrument yet devised in the US to measure flight of a missile is being integrated into the optical tracking net of the Air Force Missile Testing Center, Patrick Air Base. Called ROTI Mark II (for Recording Optical Tracking Instrument), the instrument, effective at ranges up to 200 mi, will help test Air Force's Thor and Atlas missiles. It will assist in pinpointing causes of in-flight missile failure.

Designed and built by Perkin-Elmer Corp., the instrument has components including: 24-in-aperture primary objective telescope; sighting telescopes; 70mm camera with frame rates up to 60 frames per sec; and related controls and equipment. Primary telescope has varying focal lengths between 100 and 500 in, weighs one ton, is 2 ft dia and 8 ft long, and incorporates some 200 optical elements. Entire instrument, mounted on a Navy 5-in gun mount, weighs over 8 tons.

For remote control, the ROTI station located here receives information from radar and other communication nets when a missile has been fired. Computers make the conversion into data that activate and adjust the ROTI, with automatic corrections for parallax (difference in distance and line of sight from radar to station) and for earth curvature.

When operated by range personnel, the station receives the same preliminary data but operators take over as soon as the missile is sighted. Minimum physical manipulation and simple calculations are required to follow flight of the missile. A rigid-stick control permits operator to adjust acceleration and velocity quickly, along with position of telescope. With tower housing similar to that of an astronomical observatory, the station is equipped with its own electronic and mechanical equipment, computers, film developing room, maintenance section and air-conditioning system.

Cathode rays are used to show up the missile as a pip on the oscilloscope. This locates the target even when it is obscured by clouds.

According to Dr. Roderic M. Scott, vice-president

and general manager of Perkin-Elmer's engineering and optical division, the instrument will give the Air Force information that previously could not be obtained. "Radio and radar give some information on missile flight," he says, "but ROTI Mark II (the first of four to be set up in AFMTC's range and communication net) provides an actual photographic record.

"Missile development is an expensive program. The more information that can be obtained about our missiles, the more economically their development can be carried out, the faster they can be developed, and the better they can be built. With a new missile, one can never be certain of a successful first flight. Radio and radar will tell us when the missile fails, if it does. But, by studying motion pictures of the missile in flight, it may be possible to know why it failed, saving many scientific manhours."

Technology Challenged to Defeat Mass Poverty—or Else . . .

SAN FRANCISCO—"Villagers in these parts are getting lazy. Walking was good enough for their fathers, but now they want bicycles." So said a bicycle dealer in India, explaining why footwear consumption there is going up only 4% a year, while the bicycle market is rising 25 or 30%.

This illustrates the "Revolution of Rising Expectations" outlined by Dr. A. Eugene Staley, senior international economist of Stanford Research Institute, in one of the early papers delivered before the International Industrial Development Conference here the week of Oct. 14. He pointed out that total population of highly developed areas of the world is 400 million, of intermediate areas about 500 million, and of underdeveloped areas 1,800 million.

Life expectancy is only about half as high in undeveloped areas (there are only a sixth as many doctors); supplies of cloth are only a fourth as great; and nonhuman energy only a twentieth as plentiful. Low productive levels mean poverty for most people—there are more poverty-stricken people in the world today than there were 50 or 100 years ago.

Said Dr. Staley: "Among the two-thirds of the world's people who live in economically underdeveloped countries a revolution is going on—a revolution of rising expectations. This poses opportunities and dangers. Wisely guided, it can help start tradition-bound societies moving and put them on the road to economic development. But if expectations run ahead while productive performance lags, the result can be frustration and disturbance, perhaps extremist remedies. Productive powers of underdeveloped countries must be raised. Here is the great challenge of our times."

Some 509 industrialists and businessmen from 52 free-world countries (about 150 of them Americans) attended the conference sponsored by Time-Life International and Stanford Research Institute. Its theme was "Investment and Its Relation to Industrial Development," but, as E. Finley Carter, director of SRI, said in his opening remarks: "May I suggest we interpret 'investment' in its broadest and finest sense. We should include investment of capital, of thought, of labor—even of one's self through dedication to a cause . . . understanding is the real key to the mutual confidence so essential . . . to meet our needs."

Human multiplication has become a threat to peace as communist-capitalist differences, in the opinion of Dr. Kingsley Davis, professor of sociology at the Univ. of Calif. and associated with the UN and the Ford Foundation. "At present, the rate of human increase is sufficient to double the earth's population every 42 years," he warned, "and it is increasing at 1.7% per year for the world as a whole. It could reach 3% in a few decades—doubling population every 23 years."

This burgeoning of population is caused by lowered death rates that have dropped 30 to 60% in 10 years, particularly in underdeveloped areas. Individual demands are growing and natural resources are dwindling. "The only hope is technology. But technology is very nearly a monopoly of the 'have' nations. Population growth in the 'have-not' countries makes it difficult to train technologists fast enough. The gap in per capita income between the 'have' and 'have-not' countries has widened in the past 20 years. The 'have-nots' are producing more raw materials, but consuming less . . . an ominous development."

According to Dr. David McCord Wright of McGill University, Toronto, here are comparisons of per capita gross national product in 1955:

United States	$2,343
Ceylon	122
Burma	52
Mexico	187

To raise Mexico to the US level by 1980 would require a 13-fold increase for the same population—or a 26-fold increase for the expected population. To attain a GNP of $156 billion would require about $400 billion capital—practically impossible. For Burma to achieve the same result, a 90-fold increase would be required. Some 20 countries are in a similar condition. Meanwhile, we need capital for our own economy.

The portent of all these opinions is that new developments in technology are the hope of all nations. This places the major burden for world unity and survival upon the engineers.

SAN FRANCISCO—"Militarily, the Soviet Union is not one bit stronger today than it was before the satellite was launched. The free world remains stronger . . ." Vice President Nixon said here on October 15. "The only major military significance of this event is that the Soviet Union demonstrated again what we had known before—they had developed the capacity to fire a missile a great number of miles (see *Product Engineering*, editorial, Oct. 21—written several days prior to Nixon's speech).

"But at the same time we could make no greater mistake than to brush off this event as a scientific stunt. We have had a grim and timely reminder the Soviet Union has developed a scientific and industrial capacity of great magnitude."

Contrasting cockpit panels . . .

show how ANIP simplifies flying complex new military aircraft. Multidialed instrumentation in rear cockpit is sharp contrast to panel in forward cockpit where auxiliary windshield serves as TV screen on which artificially generated picture is projected by cathode-ray tube. Flight information feeds tube from special lightweight airborne computer.

Picture Worth a Thousand Dials

Viewing both sides . . .

of a TV screen is commercial application using same ANIP-type cathode-ray tube vacuum-sealed with plate glass. Electrode elements are printed on inside surfaces of this tube phosphor-coated to give picture improved transparent quality.

LOS ANGELES—Windshield television screens from which pilots read flight data necessary to operate complex modern aircraft is now possible with a thin, transparent, cathode-ray picture tube that receives its information from a small, airborne computer. So reported Rear Admiral Rawson Bennett, chief of Naval Research, during a two-day Army-Navy Instrumentation Symposium conducted here.

Besides easing the pilot's burden, ANIP (Army-Navy Instrumentation Program) is being made available to commercial aviation. It also has application to commercial television, color as well as black-and-white.

ANIP is a two-dimensional picture presented in third-dimension perspective on a flat, transparent television tube, 2⅜ in thick, 2 in. wide, 11 in. high. Presentation is reflected on a screen (serving as contact analogue) located in front of the cockpit like a second windshield (with further development it will be the windshield). When not in use it is as transparent as a window.

Information feeds to the tube from a computer capable of 15,000 computations per sec. Designed and built by Litton Industries, Inc., the computer serves as a bantam "answer box" which can show air speed rate, Mach number, altitude and rate of climb, as well as cruise-control computations and performance predictions.

Electron beam source is at one corner of the rectangular tube—electrons travel across bottom of the picture until deflected 90° upward by one of a series of charged plates. Vertical deflector plates, transparency optional, cue another 90° directional change. The electrons then strike a phosphor-coated screen to produce visible light which the pilot sees as helpful terrain and sky information.

Kaiser Aircraft & Electronics Corp., perfectors of the tube, already has produced two-color compatible screens and has made prototypes of TV sets viewable from either side of the screen. Another application is a polar coordinate map for use with radar; here the beam source at center of tube would be deflected by concentric deflector plates to produce a map showing accurate measurements of distances and angles.

Prime contractor and project coordinator for fixed-wing application is Douglas Aircraft Corp.; entire program of cockpit instrumentation, initiated in 1953 by the Office of Naval Research, represents efforts of Army, Navy and more than 600 US companies. ANIP will be standard equipment in US Navy planes within two years.

Sleeper for cars . . .

. . . parks them on two-level conveyor belt, made by Krupp, West German steel firm, that perches two autos over ground area usually required for one. Holding up to 60 autos, conveyor consists of framework, individual trays for each car, and chains to supply motive power. Trays are supported at each corner by rollers that run in two tracks on each side of framework. At each framework end, one track projects beyond the other so trays stay level as they rise or descend. Electric motor powers endless chains that move trays back and forth around the track, bringing any desired tray in line with single opening on lower level where cars are run on and off conveyor. Besides space-saving features, device eliminates frequent jockeying of vehicles.

Military R&D Wakes Up to Sputnik

WASHINGTON—A prime after-effect of the orbiting of Russia's Sputnik seems sure to be a revamping of our military research programs—White House and Pentagon announcements to the contrary.

While it's still too early to know exact details, feeling in the military offices charged with administering research is that changes will come.

Here are some expectations:

Basic research will undoubtedly get higher priority, after being shunted more and more to the background in the past few years. Ex-Defense Secretary Wilson didn't push it, even was accused of stifling it. He wanted to see a tangible return for the defense dollar.

But Wilson's successor, Neil McElroy seems to place more stock in research. And he's supported by the nation's scientists. Reportedly, this was a point stressed hard by the 13 scientists who met with President Eisenhower recently for a post-Sputnik briefing.

Right now, of course, research contracts are being whittled. Air Force recently notified its research contractors that an additional 5% must be pared from all contracts expiring after first of the year. And at least one agency, Air Force's Office of Scientific Research, says that it has just run out of money. This means no bills can be paid, that contractors will have to work on the cuff until next January when OSR gets the balance of its '58 money.

Military spokesmen—they refuse to be named—say spending cutback in the past few months means a "loss of one to two years in the scientific effort." Within Air Force's Air Research Development Command alone some 400 contracts to universities, industry and nonprofit organizations have been terminated. (See Perspectives, Oct. 28, '57, p. 47.) In many cases, too, administrators say it "costs more to terminate the contract than it would to carry it out."

The big damage to research from the dollar squeeze, say defense officials, is that industry and universities—doing bulk of our basic research— now shy from military projects. It costs money and takes time to set up research teams. Then, if contracts are cancelled or cut back sharply on short notice, researchers are left in the lurch. And once a research team is broken up it can't always be re-formed. Effects of the so-called "short-sighted" dollar policy will be felt for a long time.

Congress may be the one to ease the money squeeze on research. Many military administrators privately admit this is what they bank on heavily. Feeling is that Sputnik will jar loose Congressional investigations, create enough publicity to bring the issue to light, and force action from the Administration.

There is even indication that the Administration may be readying to lift the military spending ceiling by asking Congress to increase the national debt limit.

Expect research projects to be coordinated. There has been sharp criticism of damage done to the research and missile programs by interservice rivalry—which is being pyramided into something of a scapegoat for our lag behind the USSR and is sure to spur an amalgamation of Pentagon efforts. It may even become the springboard to establishing a separate office to handle all missile programs. Such a move has been proposed before.

Blaming service rivalry for sorry missile efforts may backfire though. Privately, many military men say they are getting "fed up" with the charge. So far they haven't countered it publicly. But many hope Congressional hearings—if they come—will shift some of the blame to levels above the individual services.

At home, too, scientists have long blamed US security policies for driving some top talent out of defense programs—and they cite such names as Condon, Oppenheimer. More important, they say, are the unknown numbers of scientists who never enter the field because of the cloudy security atmosphere. But tampering with present security regulations is a measure that will be hard fought before any changes are made.

The Sputnik and Us

—*World Roundup of Scientific Comment*

Reaction to Sputnik throughout US was intense, some of it soul-searching, much of it jittery. Everybody—politicians, scientists, educators, even the "man in the street,"—registered emotion; the gamut ran from pure alarm to studied calm. "Pride in homeland" was hard hit. For an across-the-seas consensus, Product Engineering, through McGraw-Hill's World News Service, queried foreign scientists and engineers on their reaction to Sputnik:

LONDON—Leading British scientists agree that US prestige has suffered a body blow. In underdeveloped countries the effect is total. Elsewhere, Sputnik merely casts suspicion on US technological prowess in all fields. In Britain, most scientists think that situation is transitory, and though disappointing, is not alarming. Three factors are advanced here for the US setback:

1. Lack of concentration on fundamental research. One scientist even said quality of American research is now suspect in view of lavish equipment to be available to its scientists.

2. Interservice rivalry. Spokesman for British Interplanetary Society said, "Surely this business of interservice rivalry will now be banished forever."

3. According to this same spokesman, the US has also made mistake of complacently thinking Russian rocketry is tied to German wartime work and personnel. "It's absolutely Russian, and they have some of the best brains in the business," he said. "Sputnik is a completely superior missile to the 1942 Peenemunde 3000-mile missile." This was the missile that H. H. Koelle of Redstone arsenal was reputed to have likened to Sputnik at the recent Barcelona conference.

Another viewpoint from a British rocket expert suggested that US had seriously undersized its satellite vehicle, which only weighs 11 tons (2½ tons less than wartime V2 rocket). Sputnik weighs 90 to 100 tons. This must rob the US of design latitude if developments push up predicted weights of essential components.

The British think Russia's ICBM program is at least two to three years ahead of US program, and that this satellite demonstration is just a side show. They do not consider it any major breakthrough in metallurgy or anything else—certainly not in electronics in which US is still reckoned to be ahead of rest of world. They are convinced that in last three years the Russians have had and solved all the engine and control problems now being experienced by the US experts.

TORONTO—Canadian scientists and engineers say US has lost face over Sputnik, but "will more than make up for it later." Director of Toronto Univ. Institute of Aerophysics, Dr. G. N. Patterson said, "We feel that scientific value of Sputnik is low, but propaganda value is high. US satellite effort is painstakingly planned to help world science. Maybe US lags in development, but this is price that democracy pays for unregimented society."

Director of Toronto's Dunlap Observatory, Dr. John Heard, substantiated generally held scientific view here that US development lag is caused by lack of money, but that US brains and ability could easily catch Russian effort.

Col. T. M. Medland, executive director of the Canadian Association of Professional Engineers, said, "Prestige loss is caused mainly by US pre-Sputnik statements of how far ahead she was of the rest of world." Canadian astronomers warned US that Russia must limit her satellites or imperil astroresearch.

PARIS—There can be little doubt US has suffered loss of prestige in French technical circles as a result of Soviet success with Sputnik. Until recent months general belief here was that in technical matters, Western world could be confident America would guard its interest by maintaining a lead over Soviet world.

This feeling, however, has been undergoing reevaluation for the past year. Last August's announcement of a long-range missile was given more credence here than in States. Now Sputnik comes as final clincher. Overwhelming reaction has been gnawing fear—expressed on all sides—that perhaps the West cannot keep up with the massive Russian technical effort unless it makes major changes.

It should be emphasized that French technical circles are well aware of American ability to do all being done by Russians. The only new element is this: now the French are aware that Russia is more capable in fields once considered American preserves.

BONN—The satellite certainly has not caused major prestige loss for US here. German scientists and engineers feel that US lag is not caused by inferiority of American brains but by stronger, more concentrated Russian research in some fields.

A new, more realistic judgement of Russian abilities may lead to greater efforts in the US, and once US gives undivided top priority to this project they will quickly catch up, the Germans believe.

This opinion is general in German scientific circles, according to Dr. Julius Bartel, chairman of the geophysical-year committee, and Dr. Ernst Busse, atomic scientist with the Association of German Engineers.

Opinion, however, is split on how far Russian technology has advanced. Dr. Busse, who worked in Russia until two years ago, claims that the Russians, though gifted in mathematics, are not good at precision mechanics. He contends that Sputnik contains simple measuring instruments, whose accuracy the Russians doubt. Otherwise they would release results with a propaganda splash. He also claims Russian industry cannot

maintain precision accuracy required for large-scale production of an ICBM guidance system.

In general, the shock over Sputnik is not as great here as in US.

BRUSSELS—Beligian scientists unanimously deplore major loss of American prestige over Sputnik. But they are confident that shock will speed US developments. Liege sources blame US government rather than US scientists for present technical lag. They say America's scientists are ahead of Russia's and cite for evidence comparative weight ratios between satellite and rocket in Sputnik and Vanguard. They also say American scientists lead Russia's on key problem of getting a satellite back into the atmosphere.

Explanations of US lag focus on three points: (1) US has too many official bodies compared with Russia's centralized authority that assures fast application of technical knowledge; (2) American effort is unduly dispersed; (3) too much publicity was given the satellite beforehand, thereby redoubling present prestige loss.

ROME—While conceding Russia has won major propaganda victory and an important scientific battle, Italian scientists, and engineers remain confident in US ability to overtake Russia in this special, and necessarily limited sphere of nuclear development.

Five top physicists, three of them holding high government posts, believe Russian victory was made possible by US Administration's economizing at expense of pure research. They also cited senatorial investigations, and interdepartmental and interservice feuding as causes.

Though Russia may have ICBM, US can still reach Soviet targets from multiplicity of European-African bases over distances of one-third to one-half that Russian ICBMs must travel—this consideration reassures Italians.

AMSTERDAM—Scientists of Royal Netherlands Meteorological Institute and of Leiden Observatory report that from purely scientific viewpoint the advent of Sputnik is cause for rejoicing. "Enormous accomplishment," they say.

Entire matter is regarded as one of fair rivalry, with Soviets sprinting to an early lead in a race in which the finish line is a long way off. Dutch scientists can't understand why US feels so badly. They think US must work hard to catch up, that it's more a prestige gain for USSR, less a loss for US.

Dutch attribute US lag to Russian luck, earnest application of capable Soviet scientists, American intra-mural squabbling. They don't believe that the situation can be solved overnight, but, at the same time, they're confident that US engineering ability will assert itself and that Western European nations will, in the long run, benefit.

STOCKHOLM—Spokesmen for Swedish Academy of Engineering Sciences, and Interplanetary Society, report that scientists here were not surprised, that they've long had high regard for Russian research abilities.

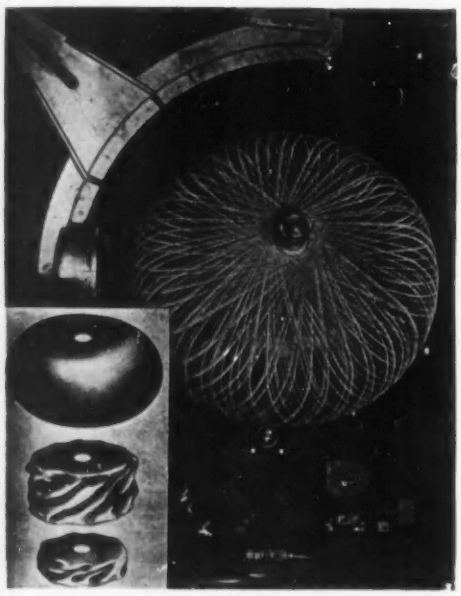
They think Sputnik can be compared in effect with Pearl Harbor, which served as an alarm clock to all-out mobilization—in this case, not of troops but of scientific resources. Battle of space is now obviously a matter between US and Russia, with latter slated for a leading role for some time.

Blame for US lag is laid to neglect of basic research in favor of too-outspoken target research, although dictatorships have advantages over democracies in such matters. Swedish newspapers interviewing top scientists have carried stories calling Sputnik a healthy reminder to those who tend to pooh-pooh a competitor.

BUENOS AIRES—A spokesman for Sociedad Scientifica Argentina said: Scientists here are vulnerable to popular sentiments. And Sputnik meant a great prestige loss for US among Argentine people. Their envy of 'colossus of the north" included hitherto deep conviction that US was vastly superior in science of arms and production. This conviction has been deeply shaken."

The Sociedad spokesman also expressed hope that when US satellite is launched, sufficient warning time will be given so Argentine scientists may make observations.

TOKYO—Japanese scientists are resentful because Russians jumped gun on rest of world by launching artificial moon that nobody could track. Dr. Masasi Miyadi, director of Tokyo Astronomical Laboratory, said Japanese scientists respect US for progressing according to schedule rather than engaging in helter-skelter race. Another Japanese scientist said that he and his colleagues think Russia and US are about even in technological progress and that except for its propaganda value, Sputnik should not be a source of gloom to Americans.



Two-for-one design . . .

of aircraft tire developed by Fairchild Aircraft Div. permits using it as high-pressure unit on pavement and low-pressure unit on rough fields. High-tensile nylon cord wound around tire body provides extra support at stress points, allows larger-size tire of standard weight. Automatic vent system gives partial deflation during landing; complete deflation and folding for in-flight storage. Inset shows tire inflated, partially deflated, and folded (⅛ size at full inflation). Application: Feeder airlines in US and abroad could use it when operating from substandard airfields.

Engineering Teachers "Moonlighting"?

URBANA, ILL.—Most teachers of engineers feel it necessary to supplement their incomes through outside work. This is the major conclusion in a report, "Salaries and Earnings of Engineering Teachers," prepared by the Bureau of Business and Economic Research of Northeastern University for the American Society for Engineering Education.

From basic data developed by the Engineers Joint Council in 1956, authors William H. Miernyk and Morris A. Horowitz find that 88% of the engineering teachers in private schools and 78% of those in public institutions earn money on the side. This "extra-curricular" income accounted for 31.5% of total earnings for the private-school teacher and for 21.8% for his public school counterpart. The survey covered 4206, or roughly 34% of all engineering teachers.

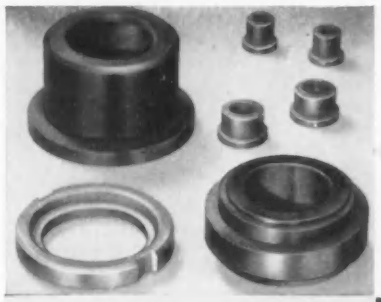
Earnings from teaching in private schools, the survey shows, average 6% over public-school teaching, and total earnings of the private-school teacher ran 21% over the public-school teacher.

The authors also conclude that income earned from non-teaching jobs is higher than that earned from teaching—at least for private school teachers. This conclusion is based on statistical evidence that total incomes of private-school teachers actually run higher than they would if the teachers taught for a full 12 months, instead of 9 or 10, and were paid for two extra month's work at a salary equal to present monthly earnings for a year.

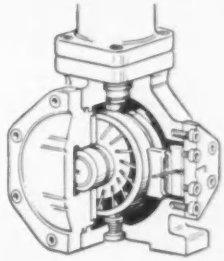
Wind Tunnel Becomes Shelf Item

LOS ANGELES—An "off-the-shelf" wind tunnel measuring 100 in.² and costing $250,000 is being marketed by Sandberg-Serrell. It includes a Schlieren system viewer, and is designed for work with closed-circuit TV for lecturers and instructors, as well as to give basic instrumentation data for inexpensive theoretical work.

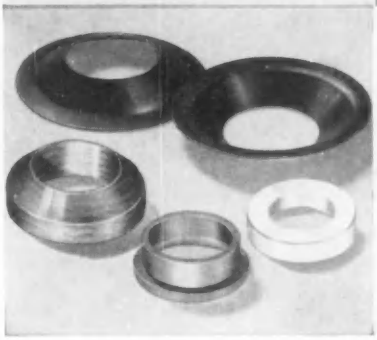
Sandberg-Serrell plans soon to offer a 16-in.² desk-size wind tunnel for $25,000 to run from Mach .4 to 4.5.

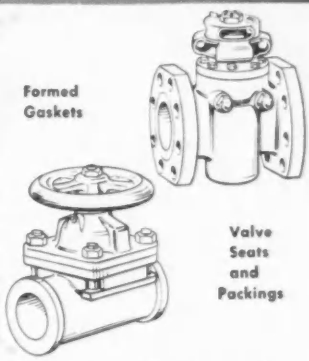


FOR:
Guide Bushings, Vanes and Wear Rings



HAVE YOU CONSIDERED THE IMPORTANT ADVANTAGES OF FILLED TEFLON*?





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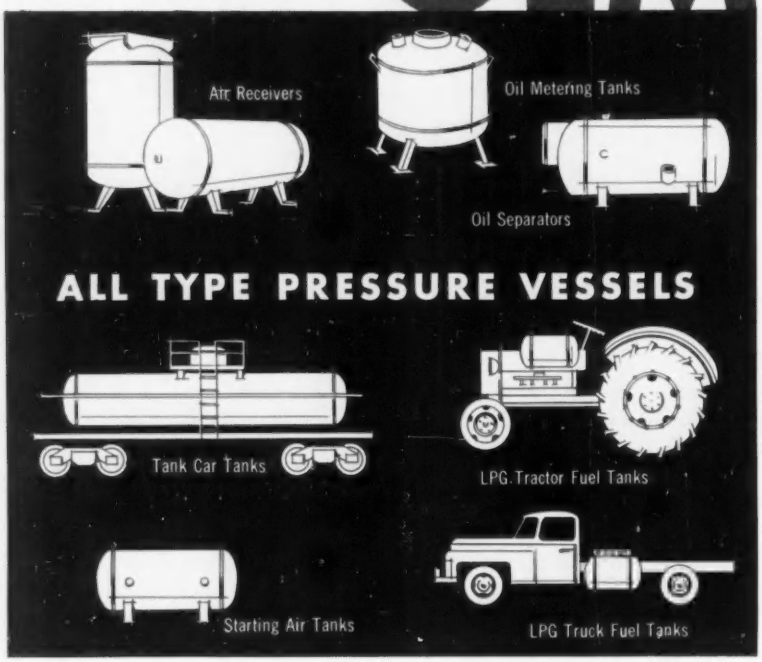

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Computer Analysis for Hire

LOS ANGELES—Ramo-Wooldridge announces expansion of its Digital Computing Center to include a new bureau that will offer computer and mathematical analysis service to industry. Dr. Walter F. Bauer will head the Computer Consulting and Service Bureau.

The company's computing center now has a Remington-Rand Univac Scientific Model 1103A digital computer with auxiliary equipment, and a staff of 140 mathematicians, programmers and operators. The center will add an IBM 704 electronic data-processing machine in January 1958.

College Offers Orbit Course

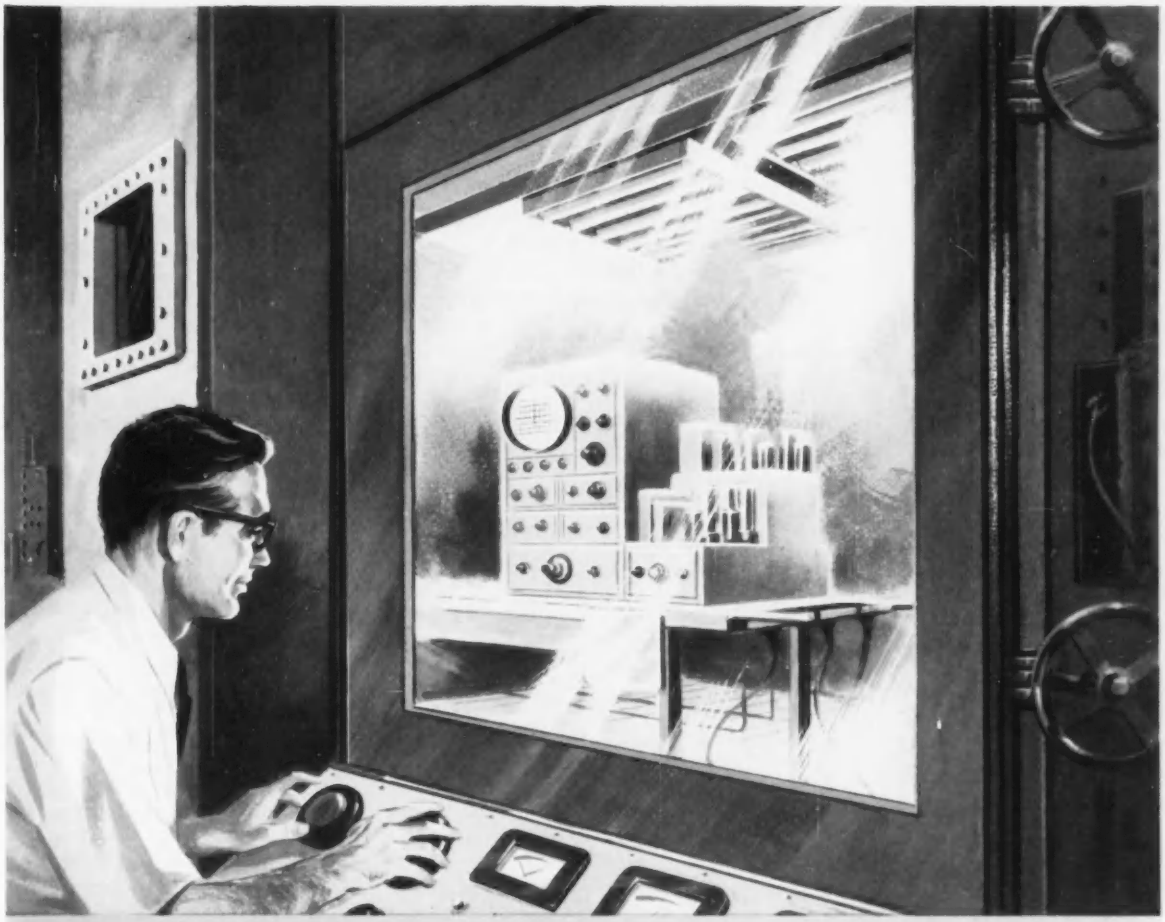
DETROIT—Here is a first in the annals of US college curricula. A course called "Mechanics of Space Flight Orbits" is being offered to graduate students at Wayne University. The 16-week study is being taught by Dr. George Loweke, associate professor of engineering mechanics.

U. S. Can't Tax This Job Refund

WASHINGTON—When a company reimburses a new employee for the cost of moving to a new job location, the US Internal Revenue Service cannot count that money as taxable income. This principle has been established in two court tests this year. In both, employees of the Sandia Corp. claimed full recovery of the tax and interest they were required to pay Uncle Sam.

The court rulings found that moving expenses are not income within the meaning of Section 22, Internal Revenue Code of 1939—and even if they were considered income, the tax payer could still treat it as a deductable expense allowed by Section 23 of the same code.

These court decisions, noted in an executive memo of the Engineers and Scientists of America, clarify a tax question that has faced many engineers who have taken new jobs in greener pastures.



THE TEMPERATURE INSIDE IS 100° BELOW ZERO— YET ELASTOMERIC SEALANTS REMAIN AIR TIGHT!

Extreme test. The sealants used in this testing chamber, as well as the sealants used for the electrical equipment being tested, must withstand temperatures as low as minus 100 degrees. Under this severe cold, most ordinary sealants would crack or shrink away, causing leakage and failure.

No cracking, no harmful shrinking. Modern elastomeric sealants based on THIOKOL liquid polymers, however, are able to withstand intense cold without losing effectiveness. Despite temperature fluctuations, they remain efficient and adhere tenaciously – without cracking or becoming brittle. Not only do these modern sealants stand up under temperature extremes, but they are also highly resistant to water, gas, air, vibration, and many chemicals. These sealants give exceptionally long life . . . eliminating the need for frequent resealing.

Commercial refrigeration. New elastomeric sealants are proving especially valuable in the refrigeration industry, where they are used to seal flooring, door jambs and other critical joints in all types of refrigeration storage. If you are faced with the problem of finding a sealant to withstand extreme cold and other hazards, we invite you to investigate modern sealants based on THIOKOL liquid polymers.

Thiokol®
CHEMICAL CORPORATION

® Registered Trademark of the Thiokol Chemical Corp., for its liquid polymers, rocket propellants, plasticizers and other chemical products.

FOR MORE INFORMATION, mail coupon to Dept. 41, Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton, N. J. In Canada, address Naugatuck Chemicals Division, Dominion Rubber Co., Elmira, Ontario.

Gentlemen: Please send me further details about modern elastomeric sealants based on Thiokol liquid polymers.

Firm_____

Street_____

City_____ State_____

Your Name_____

Designers Applaud (and Dispute) their Conclave Prophets

OJAI VALLEY, CALIF.—"Designing the Next 100 Years" was the theme of this year's annual meeting of the American Society of Industrial Designers here Oct. 17 to 20. This was drawn from the panel presentation by three California Institute of Technology scientists on the third day of the convention and recorded in their book, "The Next Hundred Years" (Sept. 9, p. 67). This unique presentation had previously been seen only by boards of directors of corporations acting as sponsors of the Institute. It covers natural resources, food, and people, and explains looming problems in all.

Dr. Harrison Brown, for example, pointed out that our dependence on technology could easily create for us a more disastrous situation than the potato blight that starved half the Irish population in 1840. Again, he indicated that, to bring India to our level would require all output of the world's present mines and factories for 100 years. Further, exhaustion of rich ore stocks will, paradoxically, require more steel to process poorer ores —causing our present rate, 9 tons per person per year, to rise to 15. He predicted a major US shift from a petroleum economy to a coal economy after we pass peak petroleum production within the next decade.

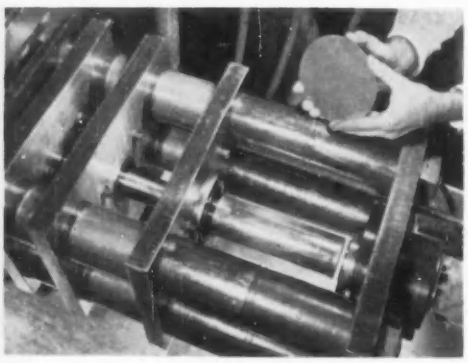
Dr. Bonner, another panelist, showed that our present 50 lb of steak/acre/year may have to yield to 2000 lb of alfalfa protein/acre/year as world population mushrooms. Dr. Weir, the third panelist, predicted we'll need twice as many scientists and engineers by the year 2000 (Oct. 21, p. 19).

Atmosphere at the Inn here is described as "conducive to relaxation." But industrial designers are creative people, so some surcharged and tense atmosphere was inevitable, and it showed throughout the sessions, particularly because more than 100 members were registered.

In the first session, for example, Anthony Morrow of Design Research Inc., Chicago, compared the psychological sense of fullfillment of a woman baking a cake to that of one having a baby. A fellow panelist, Dr. Maurice Rappaport of Stanford Research, said "Nonsense!"—and the audience promptly chose sides. Moderator Frank Breckenridge, vice-president of O'Keefe & Merritt Co., had some expert moderating to do, and even Arthur N. BacVar, manager of Industrial Design for GE's Appliance and Television Receiver Division, the other panelist, was drawn in. He pointed out that customer selection is really customer rejection—the unsuccessful design is the unbought one, regardless of surveys and studies. He also warned that surveys may cause designers to water down designs to avoid this dislike—and thus also to avoid anything that might be considered in the realm of the distinctive.

Dr. Karl With, UCLA art expert and scholar, talked one afternoon on "The Training of a Designer." He decried the salesman as too prominent in American society, suggested that "taste" is a private affair, and art a creative force that lifts native man. The panel of heads of various design school that followed him were united in their feeling of nausea at current automotive design, (the "new Victorianism") and at cliches in design, but disagreed (again!) rather widely in their ideas of how industrial design should be taught.

There were no disagreements, however, about the showing of new bathing suits (said one model, "Is this a photographer's convention?"). At the latter final meeting, new officers were introduced, retiring ones thanked, in a completely relaxed atmosphere. William Goldsmith, partner in Design Research Inc., Chicago, is the new president. The Society also honored Walter Dorwin Teague as the "first industrial designer," with a medal presented by Henry Dreyfuss.



A single stroke . . .
and this draw press will turn the aluminum disk held in man's hand into a seamless can. Kaiser Aluminum's new process permits producing cans with depths up to 3 times their diameter.

ALUMINUM CANS DEEP-DRAWN IN ONE STROKE

CHICAGO—A deep-draw process has been developed by Kaiser Aluminum's Container Research and Development Lab for single-stroke production of aluminum cans with a body depth up to three times their dia. The technique also makes possible the production of rigid, durable cans with walls as thin as 0.005 in.

Announcement of the technique coincides with news that Kaiser has installed a prototype can-making facility at its Wanatah, Ind. food-container plant. An initial order for 5½ million aluminum cans is being processed for Kraft Foods Co. Kaiser cans will also be used to package precision bearings for the Air Force, and stainless-steel welding rods for Air Reduction Co. These cans are 2¾ in. dia., the largest half-can being 7 in.

Draw depth of no more than 50% can be achieved with conventional drawing methods, and several forming operations are required before the can body can be rendered to desired shape and size.

With the new process, size and shape of deep-drawn cans for production on the same equipment can be varied. Only 15 min is required for a die changeover to effect a change in size. Highly polished surface after manufacture eliminates need for further finishing. Capital investment for a single high-speed unit is less than a third that of a conventional 3-piece can line.

Reynolds Aluminum

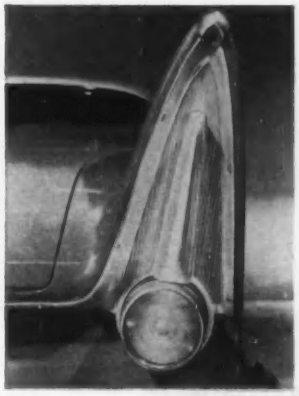
is increasing design
freedom,
adding lasting beauty,
cutting costs
in all today's fine cars*

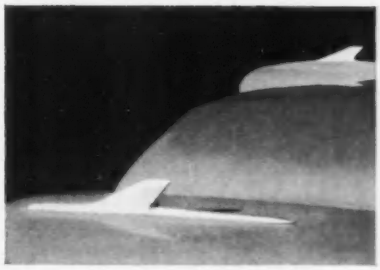
*In both '57 and '58 models, aluminum from Reynolds has been designed into all the fine cars

TRENDS

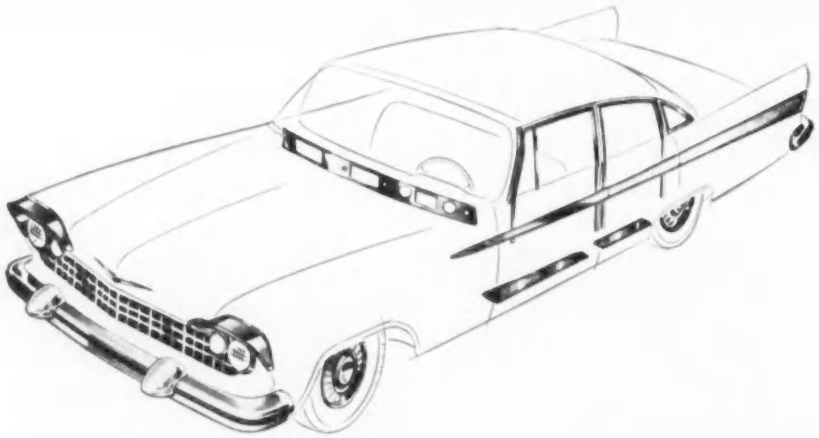
Leading off the 1958 Chevrolets are the new Impala models, a sport coupe and a convertible. Twin headlamps (separate for low and high beams) and twin parking lights, a roof air vent and down-curving fins characterize this longer, lower and wider car. The 348-cu in. V-8 engine is also new.

in appearance design...





Dimensions and such major styling details as the fins are unchanged in the 1958 Plymouth. Parking lights are the triangular lenses above and between each pair of dual headlamps. The new 350-cu in. engine is 100 lb lighter than the 318-cu in. standard power plant.



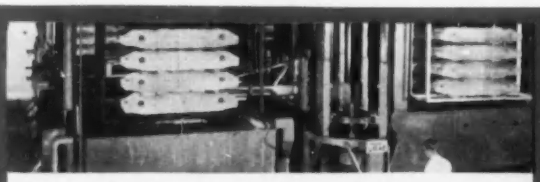
Here's why you can rely on REYNOLDS

for production of parts for the products you design

Sales appeal, quality, economy – Reynolds can give you these advantages in the aluminum components for products you design. Sales appeal through gleaming clear, color anodized, mechanical, chemical and painted finishes. Quality stemming from quality control plus technological know-how in producing and fabricating aluminum. Economy because of the tremendous variety of the most modern automatic fabricating and finishing equipment.

Whether you are designing and engineering aluminum parts for automobiles, appliances or other products, Reynolds Aluminum Specialists are at your service. For their assistance and for details on Reynolds fabricating and finishing facilities, contact your nearest Reynolds office or write *Reynolds Aluminum Fabricating Service, 2051 South Ninth Street, Louisville 1, Kentucky.*

NOTE: Before you buy any part—have it priced in aluminum. Basic material costs do not determine part costs. New techniques and processes—applicable only to aluminum—can give you a better product at a lower *final* cost.



This new Reynolds automatic aluminum finishing system can finish mixed sizes and types of automobile parts and chemically brighten or anodize them in different colors—and can handle several different jobs at the same time. An automatic coding system establishes the individual finishing specifications for each job.

Part of a battery of Reynolds new high speed buffing equipment used here on 1957 hood moldings.

The tanks in this new Reynolds anodizing installation can handle parts 24' long, 12' high and 4' wide, making it possible to handle hundreds of trim parts at one time. This half-block long system is another new addition to Reynolds multimillion dollar finishing facilities investment.

Part of a battery of Reynolds high speed coil fed presses used in the fabrication of automotive parts.

Reynolds Aluminum

Fabricating Service

DRAWING • WELDING • BRAZING
FORMING • RIVETING • FINISHING
ROLL SHAPING • EMBOSSING
BLANKING • STAMPING

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

Watch Reynolds All-Family Television Program "DISNEYLAND", ABC-TV.

THE MACHINE DESIGNER

. . . A MAN AND A TASK

GEARGE H. AMBER
PAUL S. AMBER
Amber & Amber, Consulting Engineers

What, precisely, is machine design? Who does it, and how?

Definition:

The machine designer is actually a corporate body—a number of persons working together for a specific purpose. The machine designer includes project engineers, control engineers, mechanism designers, system engineers, mathematicians, statisticians, planning and production engineers, product designers, industrial designers, human engineers, and psychologists. Executives and sales engineers, market analysts and comptrollers are legitimate members of the group because they also contribute to the ultimate product.

Ingenuity is born of laziness. Practically all great inventions were made because a naturally lazy man was set to a tedious task. As engineers we have studied principles of "least work" (nature's laziness), and, as do all men, we strive for more efficiency in everyday life—to free us for the things we want to do at the expense of those we have to do.

In exactly the same way, the machines we design to work for us—the tools, automobiles, telephones and cake-mixers—should also perform with minimum expenditure of energy, and least demand on intelligence (operator's or robot's).

However, this is no excuse for uncritical application of automation. Greater automaticity may seem desirable because it would free us from repetitive tasks. But automaticity is complex, and costly. What is saved in direct operator control may be paid for many times over in increased maintenance and repair.

Therefore, just because an operation can be automatic in no way justifies making it so. Electric pencil sharpeners are available, but most of us are satisfied with manual types. A radio that automatically tunes to the next station at the touch of a button may have some justification in a car (the driver should give all his attention to the road), but home consoles can do without such frills.

CRITERIA OF DECISION

How much automation, reliability and, yes, luxury should be incorporated in a proposed machine? Can it be made at reasonable cost? How? These are the questions facing the designer, but decisions must be based first on whether a proposed design will function at all.

Criteria of performance are the "ground rules"—specifications established by, or given to, the designer at the start of a project. The criteria need not be absolute or unchangeable—subsequent research may prove them impossible or easily exceeded. But they set up a frame of reference for measuring progress. Without clearly established criteria, the many decisions would rest on an unstable base. They would be inconsistent among themselves and with the purpose of the machine.

As the design progresses, the decisions of compromise are made and the machine takes shape in drawings and plans, so too, design criteria become fixed, usually unnoticed in the day-to-day work. In the end a test model or prototype determines whether performance criteria will be met by the design. Influence of factors overlooked or ignored, inadequacies in parts that do not perform as planned, a machine's natural orneriness—these are the things that give designers gray hair.

THE MACHINE DESIGNER

Good design, then, requires a consistency of purpose, as outlined by design and performance criteria, plus the absolute minimum hardware and complexity to do the job. Almost any designer is capable of dreaming up a machine to be made on given shop equipment that will perform its intended function reasonably well. The difference between great and run-of-the-mill design is that the "intended function" is performed by the simplest, most reliable and lowest-cost machine possible.

Note that compromises are involved here. Reliability and cost might be opposing factors, extreme simplicity might require lowered performance standards—but the really top man consistently gets more desirable features into a cheaper, simpler and more reliable machine. Ω

How to keep score on an engineering project

J. G. ADILETTA

American Machine & Foundry Co.
General Engineering Laboratories,
Greenwich, Conn.

Are your projects late? Do 90% of the costs suddenly accumulate in the final 10% of the time? Do delays catch you unprepared?

If the answer to any of these questions is "Yes", you need a control system—some way of recording and transmitting information. Written reports, tabulations, and charts or graphs are the three common methods; each has advantages in particular applications.

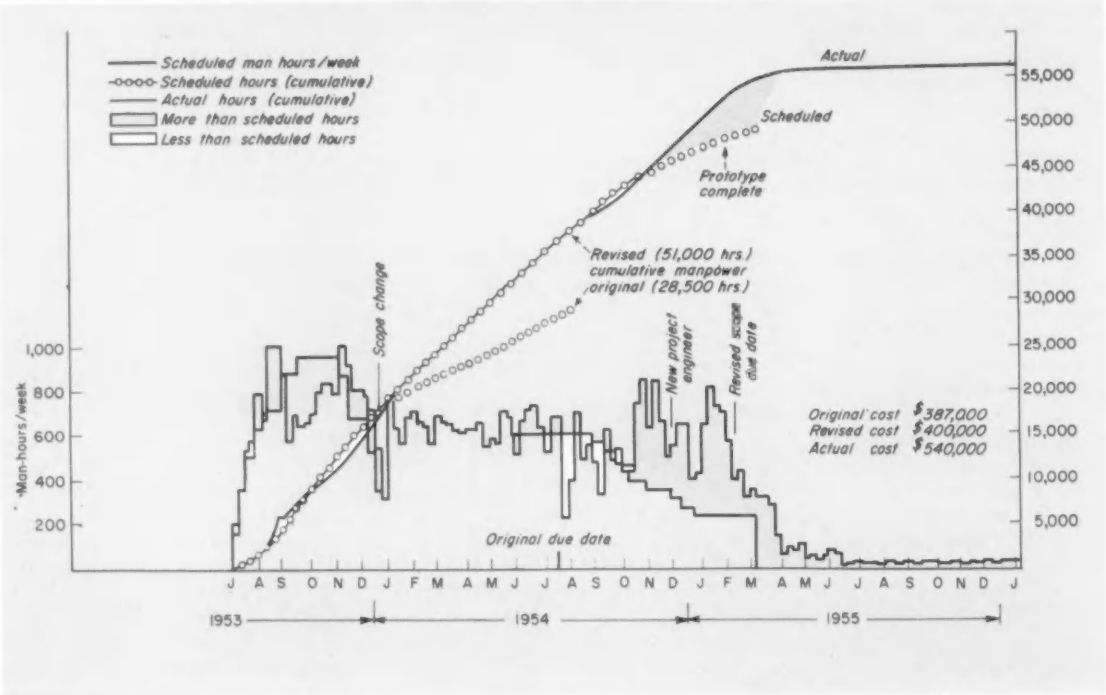
A written report will record a simple fact or two about the progress of a project, or an item within it. A tabulation or graph wastes time and effort in this case; the graph may even cause inaccuracy if specific figures must be found by interpolation.

Information for a number of projects of items is usually best presented in tabular form. Associated elements can be grouped; exact figures are in systematic arrangement. Time and effort are saved for both recorder and reader as long as the number of categories or items is not unwieldy.

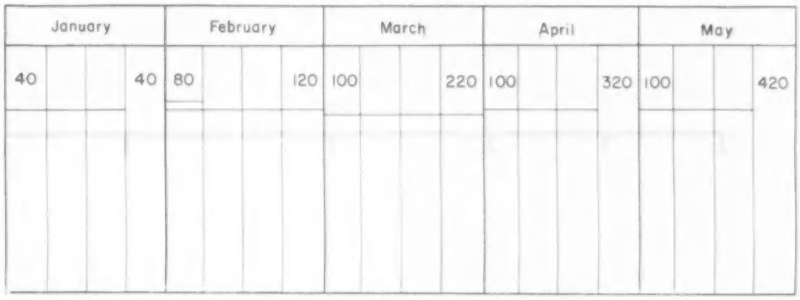
Both written and tabular methods, however, offer complications if direct comparisons (of schedule and performance, for example) are desirable. Too many words, or too many column headings, are required, so the data become confusing.

Charts and graphs, however, show clearly a comparison between performance and planned activity for a number of items or projects at regular intervals. They easily relate progress to manpower, schedule dates, and over-all project costs. Two of the most common graph types and their applications are shown here. Both are simple to produce and to read; they will show you the score without delay or waste of time. Ω

How to present manpower data



Scheduled man-hours per week, actual and scheduled man-hours cumulative, more-than-scheduled and less-than-scheduled hours—all these are shown on one chart with calendar dates as the abscissa. Notations at certain dates record program changes. Useful in planning and estimating, this chart is too all-encompassing to provide day-to-day control.



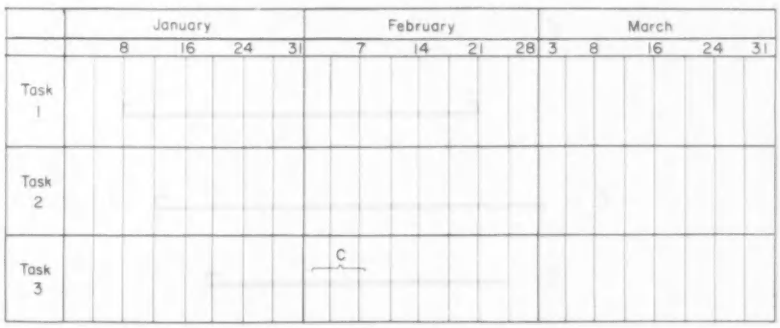
A project can be monitored with a Gantt chart

Horizontal bars or lines compare schedule and actual work done. In the 5-month example shown, for a typical manufacturing operation, each month is divided into quarters. These do not represent time, but units produced, and the value changes with the monthly budget. As charted, the Jan. budget is 40 units (figure at upper left); Feb. 80; and the remaining three months, 100 each. This makes the value of each division in Jan., 10 units; in Feb., 20; in the other months, 25.

Units actually produced are: Jan., 30; Feb., 100; Mar., 100; Apr., 75; May, 75. These totals are shown as light black lines. The Jan. line covers 30/40 of the width (showing 75% of budget completed), Feb. line covers 100/80 (showing 125% completed), etc. Lines for adjacent months are stepped up or down slightly so there is no appearance of continuity, and any overproduction (i. e., Feb.) appears as a second line above. Thus, month-by-month comparison of scheduled and actual work is charted in an easily interpreted form.

Total accomplishment for the period can also be charted against that scheduled—in this case by the cumulative line (shown in color). In Jan., lines are the same length. In Feb., however, 10 units must be applied to complete the Jan. schedule (last division), so 90 are left. This carries the cumulative line through Feb. (80 units) and 10 units into Mar. (where each division is 25 units). In Mar., the full schedule is completed, so the cumulative line projects 10 units into Apr. But in Apr. and May (25-unit divisions), only 75% of the budget is completed, so one full division is lost in each month. Thus, at end of May, the job is 1.6 divisions (or 40 units) behind schedule. This can be read at a glance.

Is is customary also to show cumulative scheduled output as a number in upper right-hand corner of each monthly division. This type of chart is named after Gantt, its inventor, has been used for decades in production control, and is still one of the most effective and graphic methods.



Engineering progress can be Gantt-charted too

Any human activity can be shown on a Gantt chart, because it relates actual progress of each task to scheduled progress relative to a time scale, and spots problem areas. Here is an adaptation charting engineering progress. Note that each month is divided arbitrarily into eight sections by dates, so the value of each division in Jan. and Mar. is 31/8 days, while in Feb. it is 28/8 (or 3.5 days). A 3-sided box (colored) shows initiation and scheduled-termination dates for each task. The V in color (at Mar. 3) signifies chart-drafting date.

It is immediately apparent that Task 1 was completed on schedule, Task 2 is one day behind schedule, Task 3 is seven days off.

Additional information can be shown on this chart by suitable notations. For example, a short vertical line with an identifying letter over it can indicate a delay and its cause, or two bracketed lines can show the duration of a delay. On Task 3, a time loss of seven days is thus shown, with an explanatory "C" for engineering changes.

1 Mathematical equation . . .
to express the problem is first developed and manually tested by Research Engineer Shaw

2 Reduced to arithmetic steps . . .
the equation is then wired into a program panel for the computer

3 Cards are punched . . .
with the data to be computed and reduced

National Motor Bearing solves

How will materials act under various conditions?

That's the big puzzler in product planning—one often answered by approximation, or even out-and-out guesswork. But it doesn't have to be.

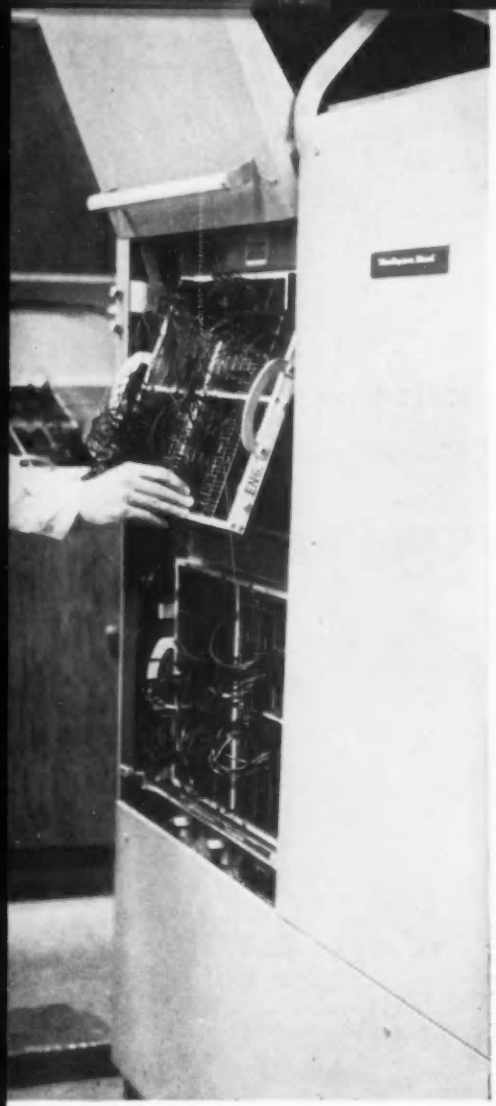
Some time ago, a Remington-Rand Univac 120 was bought to speed up ordinary accounting operations at National Motor Bearing Co., Redwood City, Calif. Then Marshall Gebert, research engineer, noted that the punched-card computer wasn't always in use. So he told R. Howard Shaw, a young M. E. on the staff who had a background in math, to hitch a free research ride whenever the machine was idle.

Shaw found plenty for it to do. The company's major products are oil and grease seals, O-rings, and shims, mostly for the automotive industry. Design questions cover materials, seal-lip configuration for efficiency and wear, and tension and temper on the annular spring that seals the lip. Each design must be separately calculated for the many applications.

After six months' experience with it, Shaw estimates the electronic machine can beat desk-calculator time about 60 to 1—besides checking out its own work.

Result: the company has freed itself from the guesswork problem.

A guess made a decade or more ago may have resulted in reasonably good performance and a product now standard. Even today, the guess has tacit acceptance be-



4 Program panel . . .
that runs problem is placed in the Univac

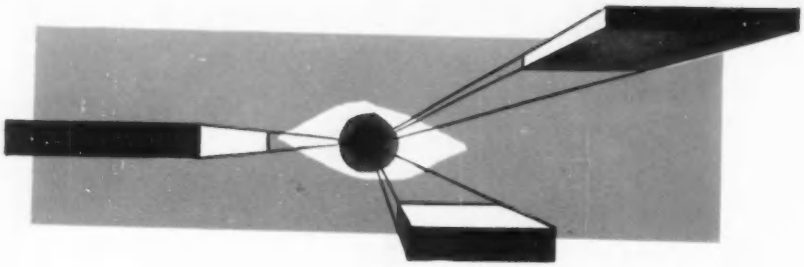
5 Cards run through . . .
at over 100 a min on the average problem

design problems by COMPUTER.

cause many designers feel they can't challenge it—equations to be solved would take too much time by manual methods and would cost as much, if not more, than the possible benefits from accurate solutions. But National Motor Bearing's experience shows the choice is no longer between manual method and no method.

Among design problems handled by its computer: Linear algebraic equations, finite-difference differentiation and integration, square roots, powers, quadratic equations. Within these functions, the computer can be wired to make "logical" choices—the answer to one problem directs the computer to take any of three alternate steps in the next phase: positive, negative or zero. Setup for a typical problem (see photos) takes about a half day, can involve 100 or more calculations.

In one typical problem, weights of metals for a given series of stamped parts were figured in an hour (960 equations) against 96 days by slide rule. To study spring tensions under varying heat conditions, 20,000 cards had to be prepared. The job took 22 hours on the computer, against six months estimated for two mathematicians working manually. On a routine research job, the computer did in 3½ min the equivalent of three days of manual calculation. Ω



POINTS

THE QUESTION: **What are the Educational shortcomings of your recently hired engineering graduates?**

"In basic sciences . . .

and various engineering studies, recent graduates are as proficient, if not more proficient, than those of past years. We find, however, as we have found over a period of years, that in general, engineering graduates are deficient in at least three respects:

"1. They are unable to get their ideas across to Management in a concise, understandable manner either orally or in the form of written reports. This indicates a lack of training in English.

"2. Their ideas of economics and general business are most inadequate.

"3. They have a very limited background in the Arts. This results in their having difficulties in industry in the general field of Human Relations, particularly with other departments of their own companies.

"In recent years, there has been a trend towards extension of the former four-year undergraduate course in engineering to five years. However, examination of the latter curricula indicates that in most cases, the additional year is devoted to further training in technical subjects. It is our opinion that it would be much more profitable to use the equivalent of this year during the entire five-year course in the types of subjects referred to above."

OSCAR G. BURCH
Vice-president Research & Engineering
Owens-Illinois Glass Co.

JOHN H. GRENNING
Chief Engineer
Micromatic Home Corp.

"The man graduating from engineering school today . . .

is better trained in the sciences and humanities than his predecessors. However, because of the intensity of the recruiting effort by certain organizations, his adjustment to the realities of industrial life is made more difficult."

OF VIEW

WILLIAM A. RAY
President and Chief Engineer
General Controls Co.

"Automatic control companies . . .

and others manufacturing highly engineered products will be more successful if their top management is cultivated from broadly experienced men with a strong engineering background. Granting this, we feel recent engineering graduates as a whole have not received sufficient academic training in such management requirements as finance, law, marketing and sales in conjunction with their engineering training.

"Without this secondary foundation on which to build, many engineers grow vertically in their field but are unable to cross over to management because along the line they have not enlarged their background in fields other than engineering. Preliminary academic instruction in these fields would encourage some engineers to broaden their experience, thus making them eligible to help fill top-level management positions in the technical manufacturing field."

DR. LESTER C. VAN ATTA
Technical Information and Education
Hughes Aircraft Co.

"College graduates . . .

generally, and particularly graduates of engineering curricula, too often are weak in the fundamental concepts of science and mathematics, and lack facility in advanced mathematics techniques. They often are unable to write or speak clear, concise English, or even to read with precise understanding, and are not well versed in economics, politics, history and other liberal arts subjects.

"The situation may be somewhat improved in the near future by the trend toward 5-year engineering courses and the introduction of more liberal arts subject matter in the engineering curriculum. Our experience at Hughes Aircraft Co. indicates that the best training for a research scientist or engineer is a liberal arts education with a broad major in the field of science and mathematics. This course also provides a proper base for graduate work in science and mathematics, basic or applied, leading to the doctoral degree which has proven to be a very desirable preparation for a career as a research scientist or engineer.

"These statements and opinions are based not only on our experience in hiring research and engineering personnel, but also on an extensive education program at the secondary school, college and postgraduate levels."

Foaming in place from a liquid stage *without added heat or pressure* is one of the most important advantages of urethane foams. They will expand and solidify in the confining area of any cavity. Complicated molds or voids can be filled completely without expensive fittings or fabrication. When foamed-in-place, urethanes form a tight bond to metals, wood, glass, fabrics and most other grease-free surfaces. When the application requires it, adhesion can be eliminated entirely with a mold-release agent.

Structural reinforcing can be simplified by foam-filled "sandwich" panels using thinner primary surface materials. Insulation of valves, piping or odd-shaped equipment can be done in less time. Foaming in place offers a simplified way to improve designs, yet at savings in manufacturing and maintenance costs.

Now: foam-in-place...

New urethane foams made with Du Pont HYLENE*

Whether your design problems require a material for structural reinforcement, thermal, sound or vibration insulation, formulators of urethane foaming compositions can *now* supply you with liquid two-part systems that offer all the unique properties of urethane foams in either rigid or semi-rigid form. These systems, customized to meet your particular requirements, can be foamed-in-place without added heat or pressure—in densities from 2 to 20 lbs./cu. ft.—to fill even the most complex cavities. The foams "self-adhere" to most surfaces while foaming. They have K factors as low as .21. Their cell structures are controllable. They offer *you* new opportunities for product design and development./ *HYLENE is Du Pont's trademark for its organic isocyanates—key urethane foam ingredients. Mail coupon today for details.

TYPICAL PROPERTIES OF URETHANE FOAMS

PROPERTY	Density of Foam (per cu. ft.) 2 lb.	10 lb.	20 lb.
Adhesion (bond strength, psi)			
to glass	9	50	142
to steel	12	62	146
to wood	17	62	170
Compressive Strength at 75° F. (lb./sq. in at 50% deflection)	10	290	—
Flame Resistance	Can be formulated to be self-extinguishing when flame is removed; burns only in direct contact with flame.		
Flexural Strength (lb./sq. in. at 75° F.)	10	275	750
Sound Absorption Coefficient (@ 500 cycles/sec.)	0.99	0.22	—
Temperature Range	to -250° F.	to 250° F.	to 250° F.
Thermal Conductivity at 75° F. (K Factor—BTU/hr./sq.ft./in./°F.)	0.21	0.24	0.32
Moisture Absorption—lbs. per cu. ft. (120 hours at 98% rel. hum.)	0.38	—	0.56

As insulating materials, rigid and semi-rigid urethane foams are exceptional performers. In *thermal* applications they are equal or superior in K value to all leading commercial insulations. At densities below 10 lbs./cu. ft. their K factor is under .25. Low density foams are particularly effective for *acoustical* insulation. Higher densities effectively reduce sound *transmission. Vibration* dampening effect is also excellent. Few, if any, other materials of construction offer the combined insulating properties of urethane foams.

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☐ Please send me a list of foaming composition suppliers.

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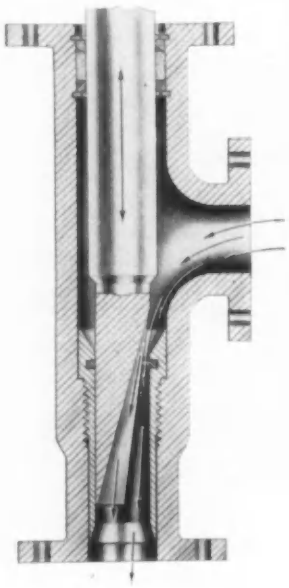
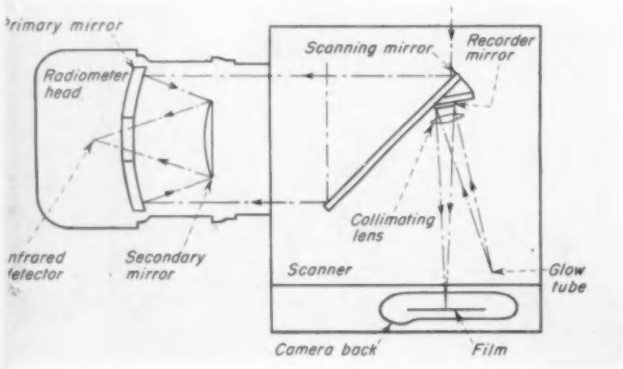
SIGNIFICANT PARTS ·



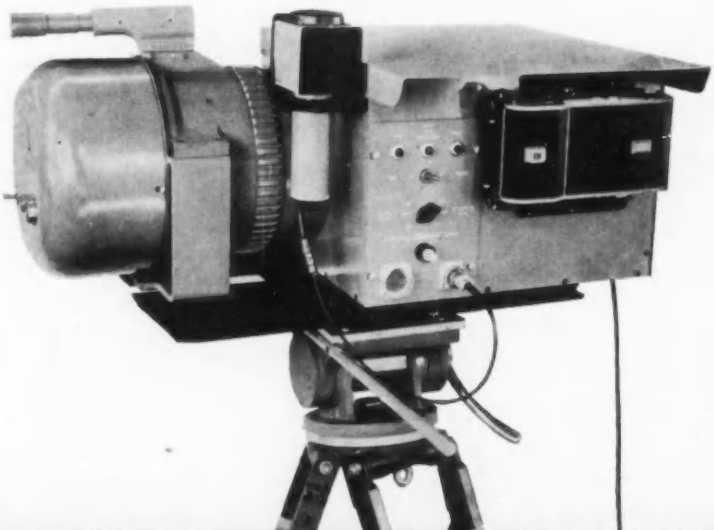
Tapered orifice valve . . .

controls flow of liquids, gases and slurries. Concentration of flow in a triangular, adjustable opening is said to eliminate clogging. Pressure ratings are 125 to 10,000 psi, in ¼ to 6-in. nominal pipe sizes. Body of valve is cast iron, cast steel or forged steel. Price range, $20 to $600, depending on size; delivery, 1 mo. **General American Valve Co., P.O. Box 444, Corona Del Mar, Calif.**

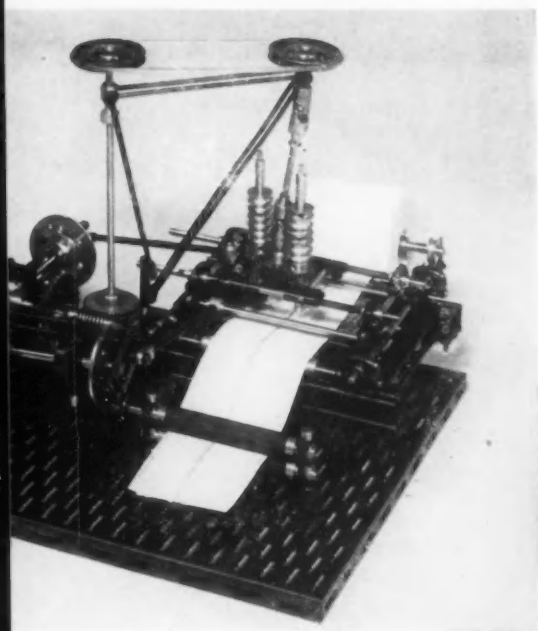


Infrared camera . . .

converts heat radiated by objects into light, providing quantitative photographic records of temperature distribution on regular black-and-white film. Device consists of a radiometer system for measuring infrared radiation; a scanning attachment; a regular camera. Temperature differences as small as 0.02° can be detected. These heat pictures can show hot spots in various types of machinery, equipment and processes while they are operating. In some cases, causes of heat concentration can also be determined with this camera. Price, $20,000; 90-day delivery. **Barnes Engineering Co., 30 Commerce Road, Stamford, Conn.**

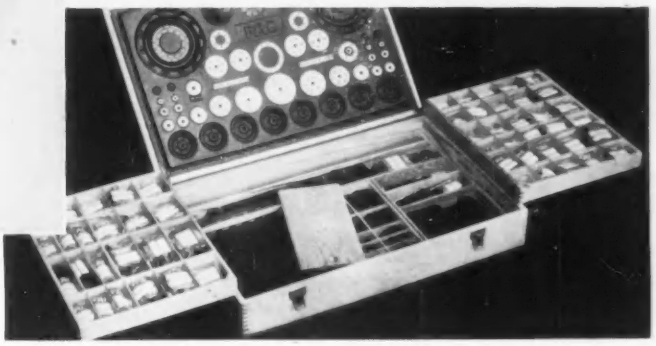


MATERIALS · EQUIPMENT



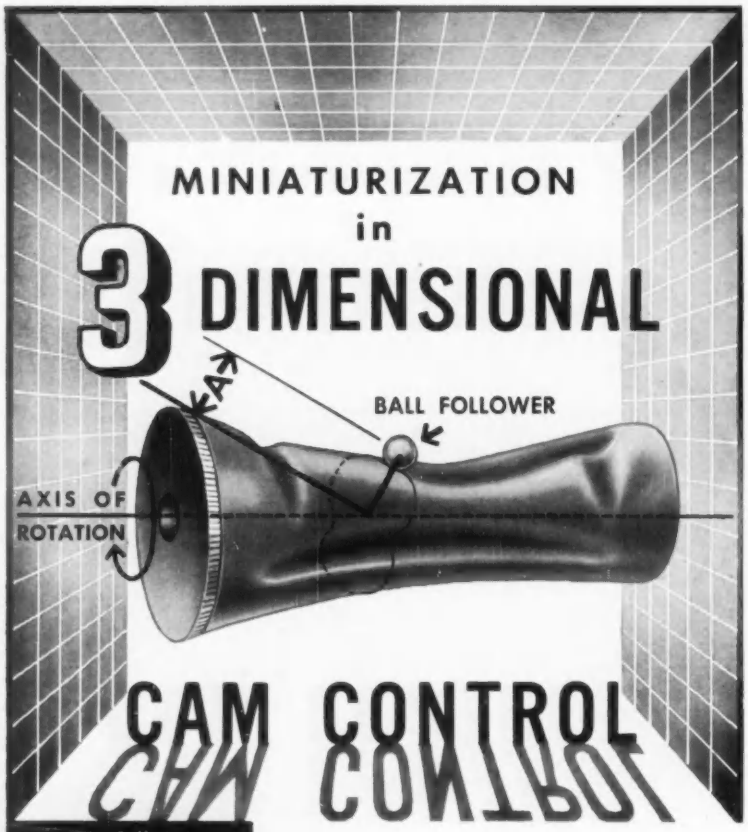
Low-cost, mechanical mock-up kit . . .

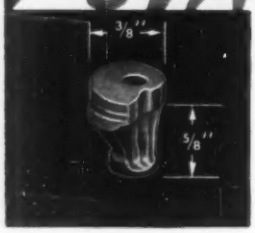
from Sweden provides the makings of precision working models of machinery. Includes bearings, gears, gear racks, ratchets, sprockets, pulleys, sheaves, couplings, springs, wheels and disks. These parts can become reciprocating and slide motions, geared transmissions, differentials and universal joints. Basic kits (largest, 5000 parts) and extra parts are available from US warehouse stock. Price: $250 and $400. **FAC Div., Overseas Commodex Corp., 9551 Grand River Ave., Detroit 4.**



Porous solid releases liquids or gases . . .

at controlled rates, generally to pressure, and redistributes remainder through the solid by capillary action. Any degree of resiliency is possible in this material. When used alone it provides a waterproof substance that can control air passage. Liquids are held between heat-fused, 6-micron spheres of vinyl, vinylidene chloride, nylon or other resins during shaping by molding, casting or rolling. Probable uses include self-inking typewriter keys, vehicles for anticorrosive and other protective impregnants, permanently lubricated bearings, batteries, filters, insulation, and packaging. The material will be supplied to specification for customer applications licensed by the manufacturer: **Perma Industries, Inc., 4169 Beverly Blvd., Los Angeles 4.**





The dimension "A" changes over 13,000 specified times as the ball follower passes over the surface of this precision Parker 3-Dimensional Cam. Actually the changes are infinite due to precision interpolation between specified stations.

Output functions of this miniature precision cam change thousands of times, too . . . and the repetitive accuracy, because it is a mechanical control, remains constant.

If you have control problems where a mechanical control has advantages—where control space and weight factor or where environmental extremes affect accuracy—look to Parker for 3-Dimensional Cam Controls and dependable repetitive accuracy.

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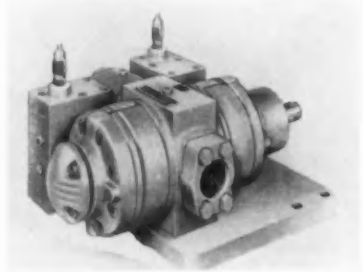
SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .

Heavy-duty trigger switch . . .

helps control electric circuits in mobile equipment and where the operator needs freedom of movement for better visibility or safety. Momentary-contact switch in a pistol-grip handle is installed at end of a heavy-duty cable. Switch is waterproof, trigger travel is adjustable and meets Navy specifications. Electrical rating is 10 amp, 125 v ac at 0.80 power factor. Switch is DPST, normally off. Can be supplied with a four-conductor cable of any length. **Electro Switch Corp., Weymouth 88, Mass.**



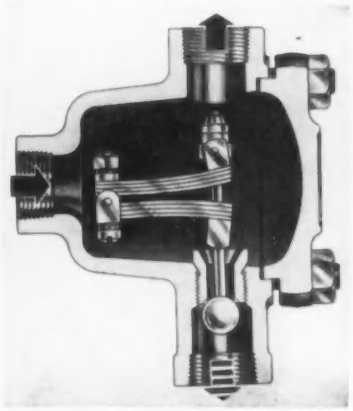
Double pumps . . .

for hydraulic oil service at pressures to 2000 psi and speeds of 1200 and 1800 rpm are offered with base or flange mounting and with or without panel-mounted valve combinations. Capacities of each cartridge section range from 3 to 18 gpm or any combination of these volumes. **Gerotor May Corp., Owings Mills, Md.**

High-temperature foam . . .

is a one-component, pack-in-place material that requires no mixing. Resembling damp sand, it is packed into cavity to

be filled, around inserts and embedded items. Curing at moderate temperatures, does not change volume. Resultant foam is rigid to 500 F. Weight: about 20 lb/cu ft. At microwaves, dielectric constant is less than 1.5, dissipation factor less than 0.009. The foam is used to embed electronic circuits, void filling and thermal insulation. Available from stock at about $2.75/lb. **Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.**



Safety device . . .

protects condensate lines in cold weather, where temporary pressure failure can mean freeze-ups and broken lines. Consists of bimetal element in forged-steel body with stainless-steel trim and Stellite-coated valve seat. It is installed in low points; normal temperature of condensate keeps valve closed. Temperature drop of boiler-pressure failure or line blockage causes element to open valve to atmosphere at predetermined temperature of 90 to 120 F. The ½-in. orifice drains lines before freezing can take place. Installs as a standard pipe fitting without additional piping. Stocked in ½, ¾ and 1-in. connections. **Velvan Steam Specialties, Inc., 700 New York Ave., Union City, N. J.**

Plastic protective coating . . .

formulated from silicones and epoxies, is resistant to corrosion, impact, temperature, abrasion, weather and moisture. It will not chip or peel when bent or dented. Cures by both solvent evaporation and internal polymerization, yielding a surface finish with greatly increased molecular weight and positive-bond and surface-hardness characteristics. Coating, which comes in a three-part package (resin, activator and thinner), is mixed—then brushed, sprayed or dipped on. Clear plus 22 colors in gloss finish are standard; semigloss and flat can be ordered. Has been used as protective coating for equipment, structures, tanks, floors, trucks, boats, ships and machinery. **Mono-Seal Products, 44 Garden St., Everett 49, Mass.**

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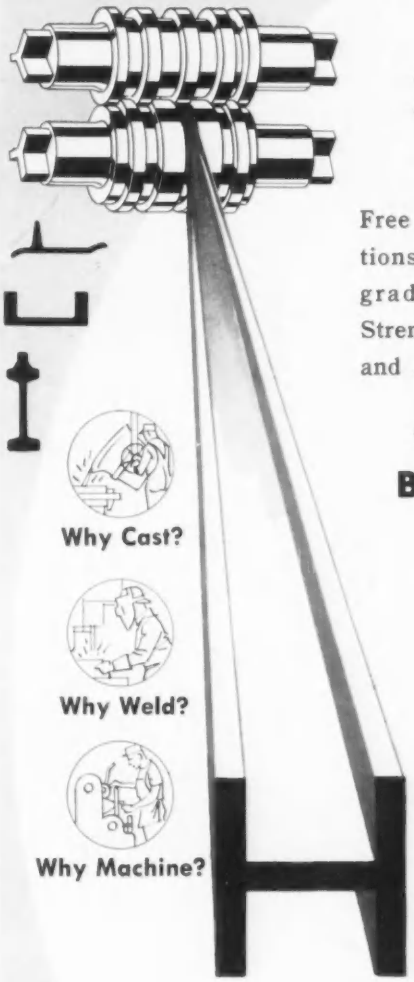

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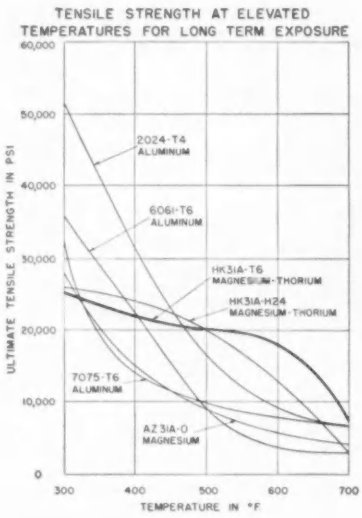
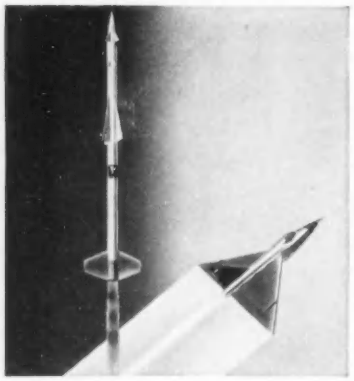


Creep Resistance at 300°-700° F.

In this temperature range, use the thorium-containing alloys of magnesium. They are the only satisfactory metals which combine creep resistance with good strength and light weight.



For designers of high speed jet planes, rockets, and guided missiles, this solves a problem. Formerly it was thought necessary to use heavy materials. They are less satisfactory than these magnesium alloys.

Formerly available in the form of castings only, thorium-containing magnesium alloys now come in rolled sheet. B&P's mill produces this sheet.

B&P engineers will help you redesign in magnesium. B&P offers the magnesium industry's most complete facilities for fabrication and assembly. Your inquiry will bring a descriptive booklet.

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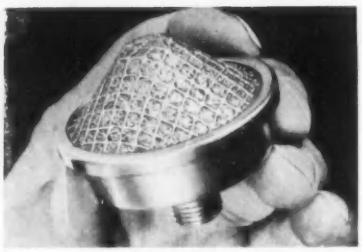
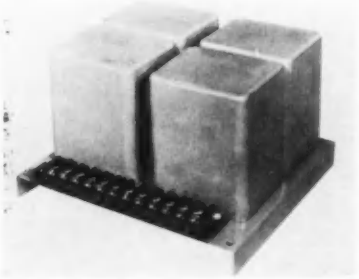
SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .



Silencer . . .

for air exhaust from air-operated equipment breaks up shock waves created when exhausting compressed air to atmosphere, and reduces noise levels. Efficiency of the air-operated equipment is maintained. Self-contained assembly has standard pipe thread and mounts directly on any discharge port or piping. Metal unit can be cleaned with any commercial solvent. Equally effective as intake silencer for use on vacuum pumps and small gas engines. Standard sizes are for $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$-in. pipe. **Air-Maze Corp., 25000 Miles Rd., Cleveland 28.**

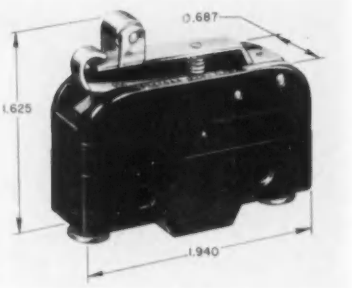


Anti-repeat press control . . .

uses magnetic amplifiers, diodes, transistor and pulse transformer instead of relays to eliminate moving parts. Device goes between operator's control buttons and the press; prevents operation of press unless safe conditions exist. The anti-repeat press control has external connections like those of conventional controls and operates on 115 v ac. It receives input signals from press and the press limit switches (start, stop, inch) and delivers its output to magnet of air valve. **Clark Controller Co., Cleveland.**

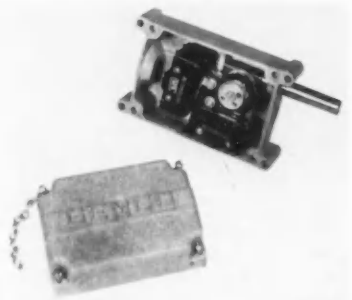
Vulcanizes at room temperature . . .

to form a silicone rubber with excellent resistance to weathering, moisture, heat and cold. Material is recommended for encapsulating electric and electronic parts and for general potting, sealing and caulking applications. It has a long shelf life in the unvulcanized state, is easy to handle and blend, and retains its rubber-like properties over a temperature span of —70 to 500 F. Vulcanization takes place within 24 hr at room temperature. Compound is completely stabilized after 48 to 72 hr. Moderate heating, to 200 F, will accelerate curing. **Dow Corning Corp., Midland, Mich.**



Roller lever-actuated switch . . .

has low pretravel, close repeatability and stability, and high overtravel. Because of the high overtravel, switch can be used with fast-moving cams. Case is asbestos-filled phenolic. Electrical rating for switch is 125, 250 or 460 v ac at 10 amp. Contact arrangement is SPDT. Various terminals are available. **Micro Switch, div. Minneapolis-Honeywell Regulator Co., Freeport, Ill.**



Rotary limit switch . . .

has three microswitches and three independently adjustable cams. Special cams with multiple lobes can be supplied. Ratios of 5:1, 10:1 and 20:1 are standard. Standard case is molded plastic, but watertight and explosionproof aluminum cases are available. Switch was primarily designed for machine tools, automation equipment, motor-operated doors and windows, or any application where a motor drives a mechanism through a rotating motion. **Gemco Electric Co., 25685 W. Eight Mile Rd., Detroit 40.**

Pressure pickup . . .

compensates for sensitivity, zero balance, temperature-caused zero drift and sensitivity change, input impedance and output impedance. Max nonlinearity deviation is 0.5% F.S.; hysteresis to 0.25% full-scale, and repeatability to 0.1% full-scale. Operates between —65 F to 300 F. Unit incorporates a four-active-arm, unbonded strain gage in Wheatstone bridge configuration. Units will be available in pressure ranges from 0-500 to 0-5000 psi. **Dynamic Instrument Co., 28 Carleton St., Cambridge 42, Mass.**

High-pressure transducer . . .

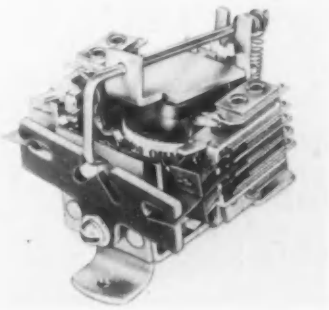
converts pressure directly into a linear electrical signal. It's a piezo-electric quartz pressure transducer, for transient pressures to 100,000 psi, not subject to drift or shift. Has high frequency response, strong signal and durable construction. Dimensions are 1⅜ in. dia x 1⅝ in. high. A holder and piston are available for attachment to the pressure source. **Frontier Products Co., 4200 Deepwater Terminal Rd., Richmond 24, Va.**

Bearing material . . .

requires no lubrication in sliding and rotating service to 500 F. Suitable for use with solvents and practically all types of corrosives. It will not be permanently deformed by shock. Material has a static or kinetic coefficient of friction against polished steel of 0.04, PV factor to 10,000. It will withstand speeds to 1000 rpm, loads to 100 psi. **Crane Packing Co., Dept. PEN, 6400 Oakton St., Morton Grove, Ill.**

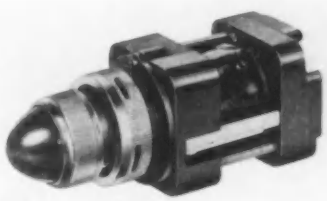
Plastic, pressure-sensitive tape . . .

in transparent, opaque finishes and 12 colors is said to have nine times the impact resistance of cellulose tapes. It will adhere to damp surfaces indefinitely. Tensile strength of 22 lb per in. of width is maintained even after prolonged soaking. Max water absorption is 0.05%. Maintains optimum adhesion from 122 to 140 F and can resist temperatures to 180 F for extended periods. Tape is 0.0023 in. thick, is manufactured in ¼-in. widths up, in ⅛-in. increments, on 3-in. cores containing 72 yd. **Mystik Adhesive Products, Inc., 2635 N. Kildare, Chicago.**



Single-coil latching relay . . .

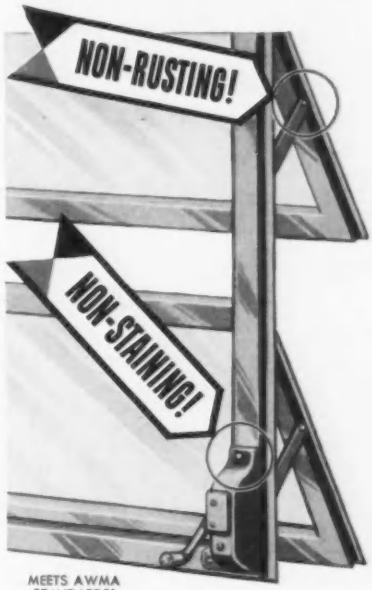
selects alternate circuits or circuit modes on successive impulses. Armature-driven, rocker-type actuator transfers one, two, three or four DPDT snap switches. Gold-flashed silver-cadmium oxide contacts are rated 10 amp, 115 v, ac resistive. Operates from ac or dc sources and provides positive transfer on a single 30-millisec impulse. Designed primarily for on-off and reversing features. Used for remote controls and other applications requiring a low-cost means for transferring between alternate circuits at undefined periods. **Potter & Brumfield, Inc., Princeton, Ind.**



Push-to-test pilot light . . .

permits testing bulb by pushing color cap. Oil-tightness of unit is maintained in both normal and depressed or test position. Internal connections are of silver-plated beryllium-copper. Units occupy same panel space as standard Type-T pilot light and can be mounted next to one another. **Square D Co., 4041 N. Richards St., Milwaukee 12.**

How Alcoa Aluminum Fasteners make good windows even better



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You can meet the highest standards of quality and the specifications of the AWMA (Aluminum Window Manufacturers Association) for prime windows of aluminum when you assemble with Alcoa® Aluminum Fasteners. Perfect color match and protection against both galvanic and atmospheric corrosion make for lasting good looks . . . consumer satisfaction. Complete stocks carried by your local Alcoa distributor fill every requirement. He is listed in the Yellow Pages of your telephone directory.

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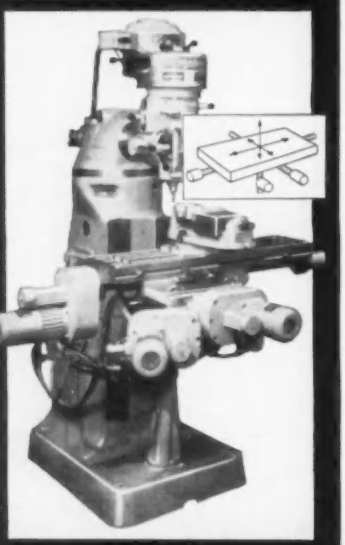
The Same Beaver Ball Screws Used Extensively in the Ships You Ride Offer Better Control in Machine Tools Too!



This Bridgeport milling machine with DIGIMATIC tape control system by Electronic Control Systems, Inc., employs Beaver Ball Screws for activating the table in 3 dimensions. Beavers were selected for this job for their accurate positioning, speed, control, high efficiency and virtual freedom from backlash. We have worked with many machine tool builders in automating their equipment. May we help you, too?

Beaver Precision Products INC.
CLAWSON, MICH.

SIGNIFICANT PARTS
MATERIALS
EQUIPMENT . . .

Protective switch . . .

is actuated by thrusts, impacts or excessive vibrations. Gives full-time protection to unattended industrial equipment. Once actuated, switch cannot be jarred back into an unactuated position. Manual or electrical resets are provided. Force-of-actuation settings are factory-adjusted and can be supplied from 1.5 to 10 G or higher. Contacts are SP, normally closed. Switch is rated 1 amp, 6 v dc. **Micro Switch, div. Minneapolis-Honeywell Regulator Co., Freeport, Ill.**

Zone-hardened ball bearings . . .

are mounted in a synthetic, oil-resistant rubber ring that fits snugly in a pressed-steel housing. Bearings are available in pillow block, flange and cartridge units. Units are prelubricated at factory and sealed for life. Static discharge wire is provided. **Sealmaster Bearing Div., Stephens-Adamson Mfg. Co., Aurora, Ill.**

Corrosion-resistant solid-film lubricant . . .

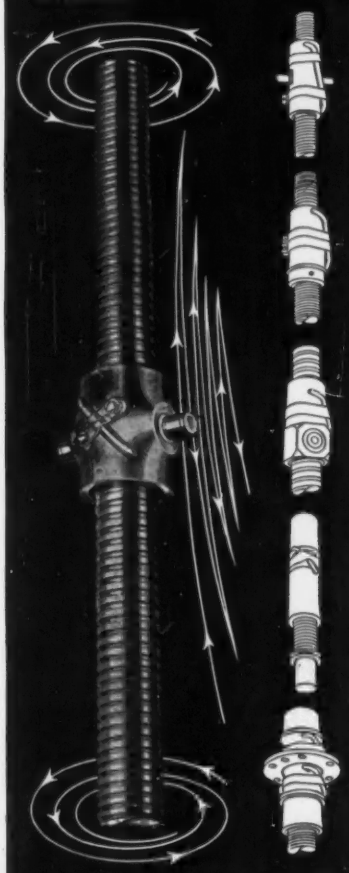
has friction coefficient of less than 0.04 and is said to withstand 1300-hr salt spray tests on anodized aluminum. Coating is effective from −65 to 600 F, as well as for high loads and high speeds. **Electrofilm, Inc., P.O. Box 106, North Hollywood, Calif.**

High-temperature hose . . .

contains no metal, is corrosion-proof, nonswelling and noncontaminating. It combines high-voltage insulation, protection against corona and moisture absorption, has good flex-lite and vibration resistance. The Teflon hose is available from stock for delivery within 2 wk. Approximate price for a ¼-in. assembly, with fittings, 1 ft long, is $10. **Resistoflex Corp., Roseland, N. J.**

beaver ball screws

Successor to the Acme screw drive and preferred in many applications to hydraulic and pneumatic systems. Guaranteed 90% efficiency in converting rotary twist to linear push (or vice versa). Employs a stream of precision balls and ground lead to eliminate drag and wear in delicate instruments to massive wind tunnel jacks. Any diameter or travel: indexing, inching, traversing. Literature, consulting engineering service available.



Fastest growing source for ball screws

Beaver Precision Products INC.
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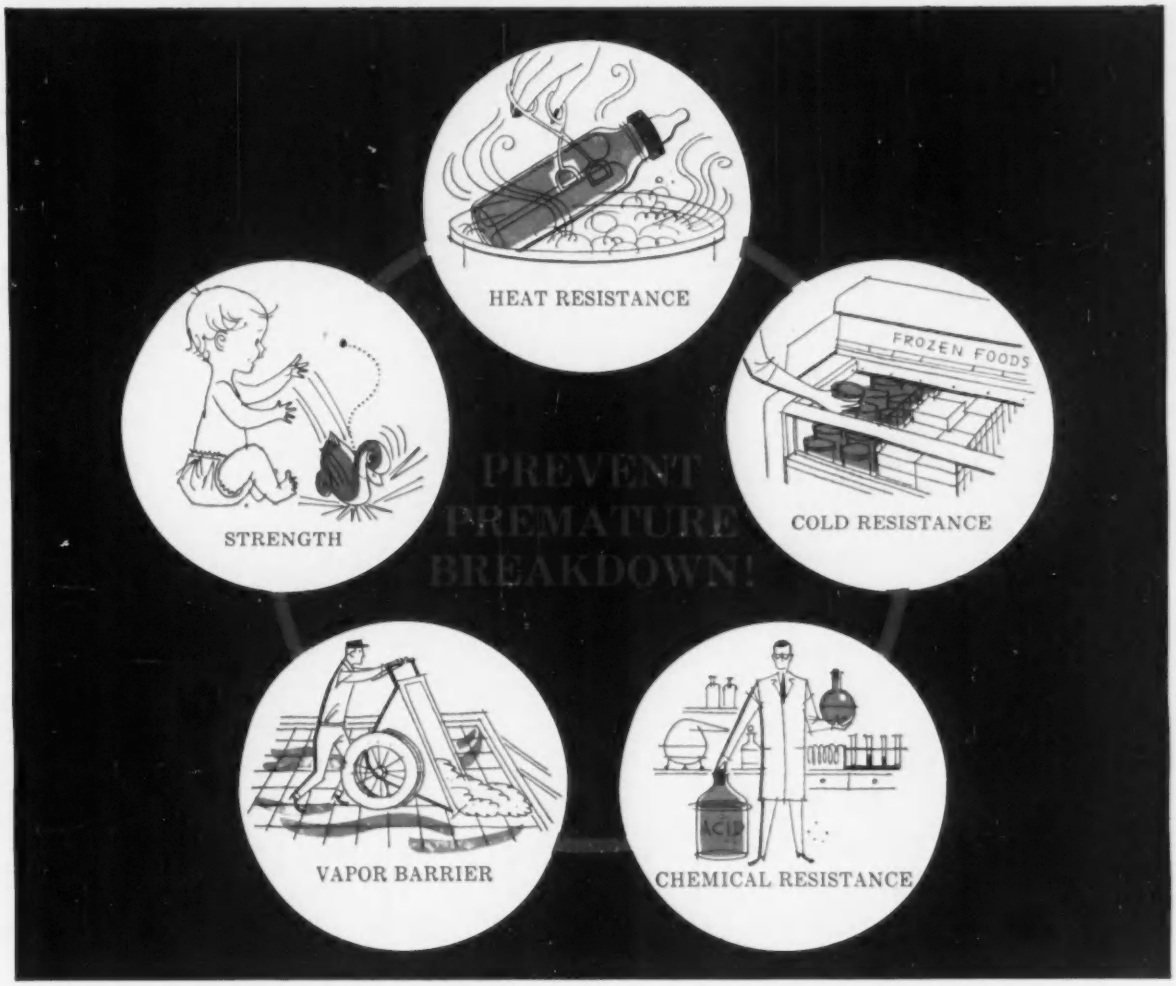

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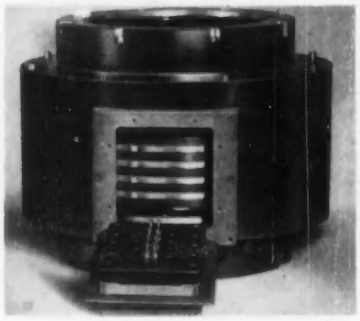

Sealed slip-ring assembly . . . can take electrical current for instrument-signal or power purposes from a rotating power source and apply it to stationary equipment. Originally made to check strain-gage readings aboard ships. Adaptability is due to large-size rings and brushes, which will withstand power circuits. Also, silver-graphite brushes are combined with coin-silver rings to render accurate readings. Assembly has 6¾-in. ID, 13⅝-in. dia, 10⅞-in. length. **Superior Carbon Products, Inc., 9115 George Ave., Cleveland 5.**

Variable-speed, dc motor drives . . . have silicon power rectifiers. With single and three-phase inputs and power outputs from 1/6 to 15 hp. Provides continuously variable power to operate from zero rpm to rated speed and constant-torque motor operation. No rotating parts or electronic tubes are used. **Power Control Co., 71 Okner Parkway, Livingston, N. J.**

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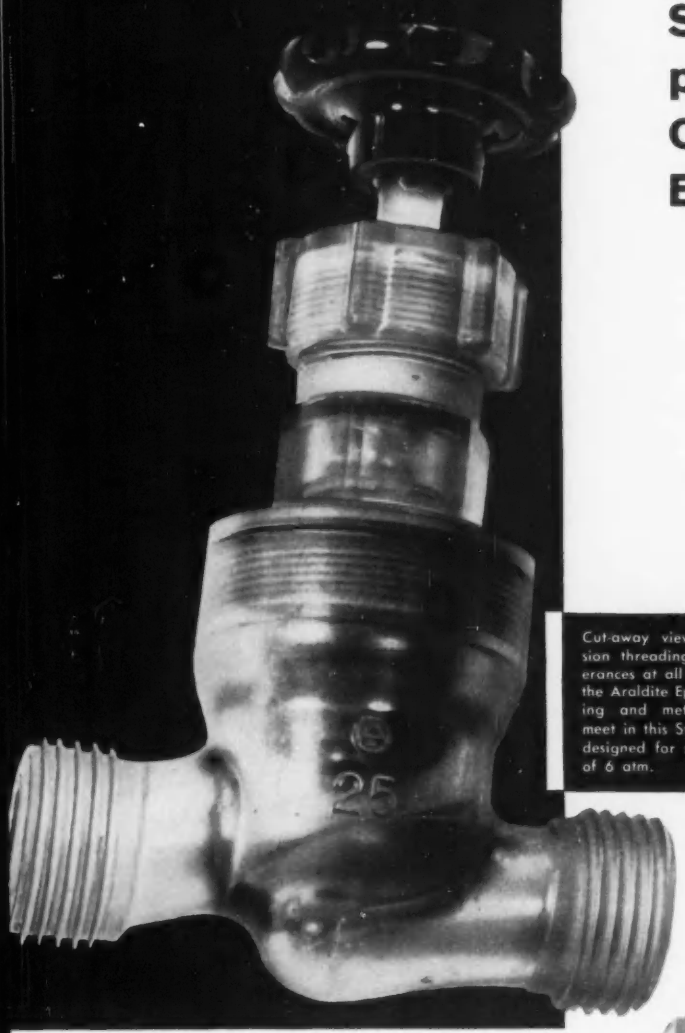
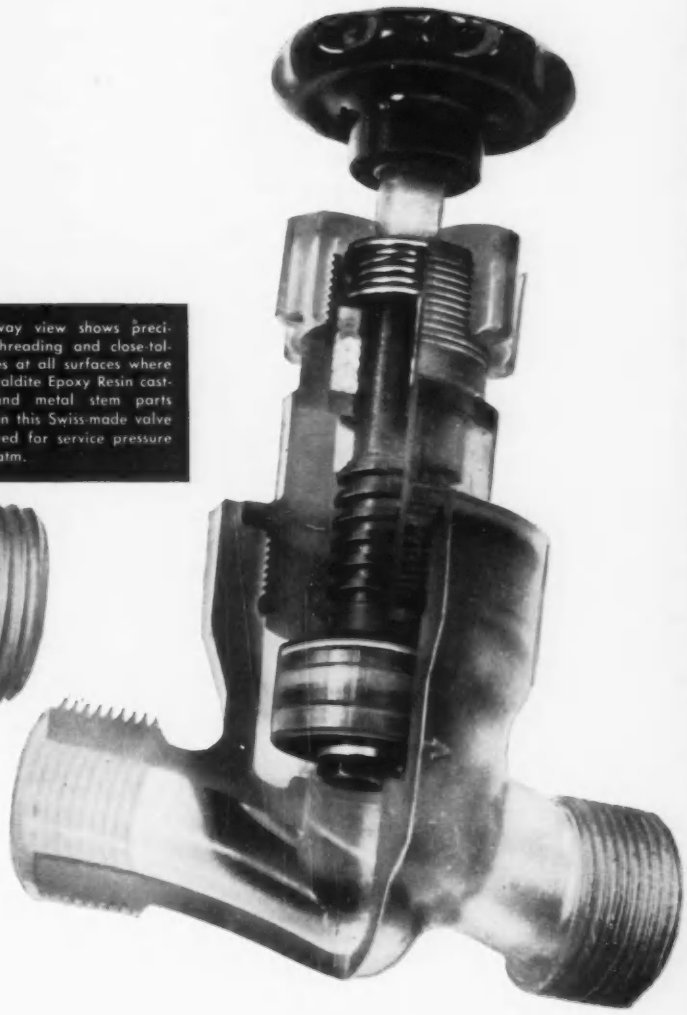
. . . Mass-produced STRAIGHTWAY VALVE precision-cast in CIBA Araldite® Epoxy-based resin





Cut-away view shows precision threading and close-tolerances at all surfaces where the Araldite Epoxy Resin casting and metal stem parts meet in this Swiss-made valve designed for service pressure of 6 atm.

High strength, dimensional stability, corrosion resistance, ready conformity to precision design specifications enable Araldite Epoxy Resins to bring both new looks and new efficiency on a low cost multi-unit production basis to an ever-increasing range of industrial and household equipment. To learn more about the new era of product design emancipation that Araldite Epoxy Resins are pioneering, check in the coupon below the fields of your particular interest, and send to CIBA Plastics Division Technical Service Headquarters.

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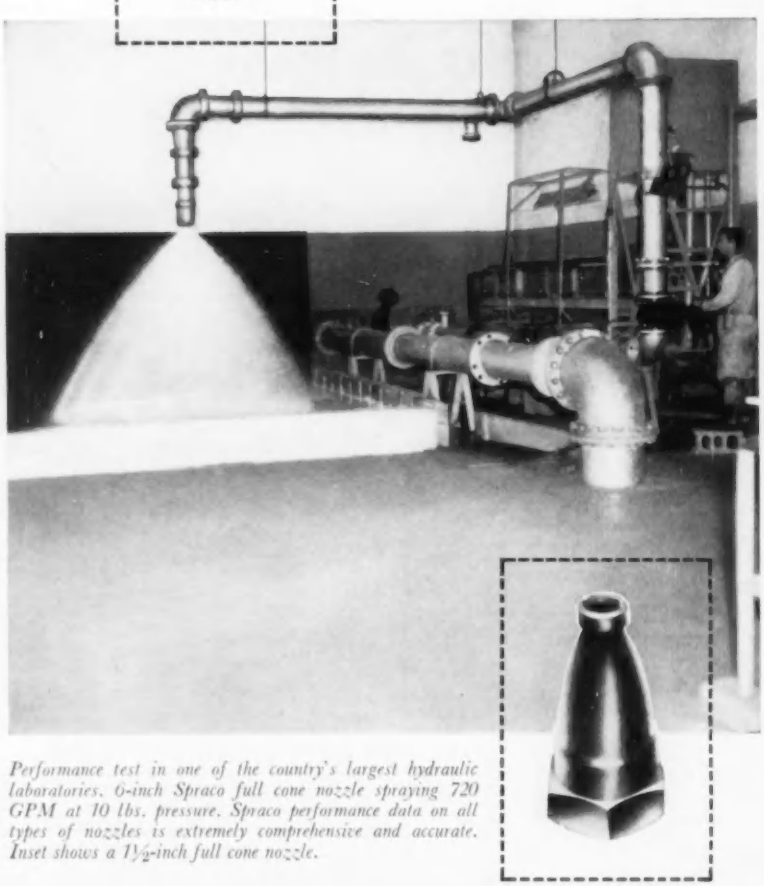

Performance test in one of the country's largest hydraulic laboratories. 6-inch Spraco full cone nozzle spraying 720 GPM at 10 lbs. pressure. Spraco performance data on all types of nozzles is extremely comprehensive and accurate. Inset shows a 1½-inch full cone nozzle.

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will not support combustion. If subjected to direct flame, it is self-extinguishing without after-glow when the flame is removed. Made of a lightweight, reinforced phenolic that does not warp or sag under temperatures normally encountered in panelboards. All standard sizes and styles are available. **Stahlin Bros., Inc., 487 Maple St., Belding, Mich.**

Receptacles for fasteners . . .

for side and corner mounting eliminate the need for a mounting flange and permit maximum accessibility to working areas. Mounting holes have been reduced from four to two and holes have wider tolerance to permit automatic prepunching. Designed for light loads, the receptacles are die-cast of aluminum alloy, anodized in accordance with military specifications. **Camloc Fastener Corp., 22 Spring Valley Rd., Paramus, N. J.**

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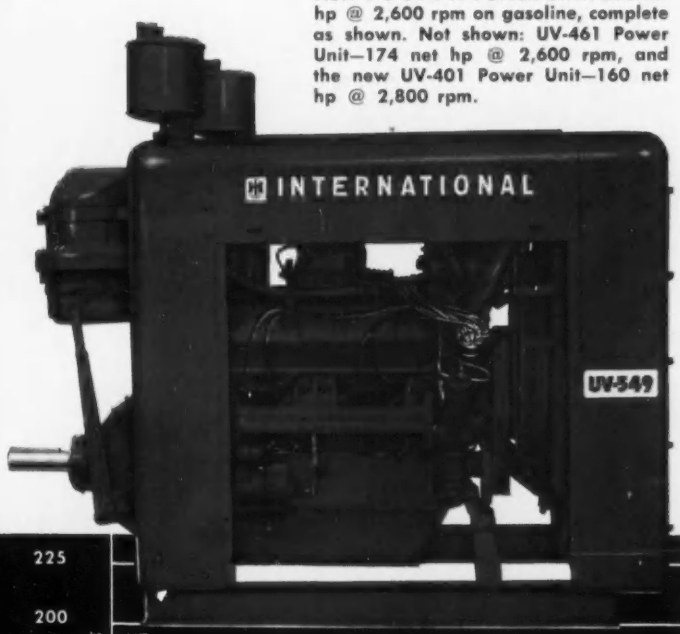
Now you have an even wider selection of economical International gasoline or LP-gas power for your products—three new power-packed, compact V-8's—the UV-549, UV-461, and the UV-401.

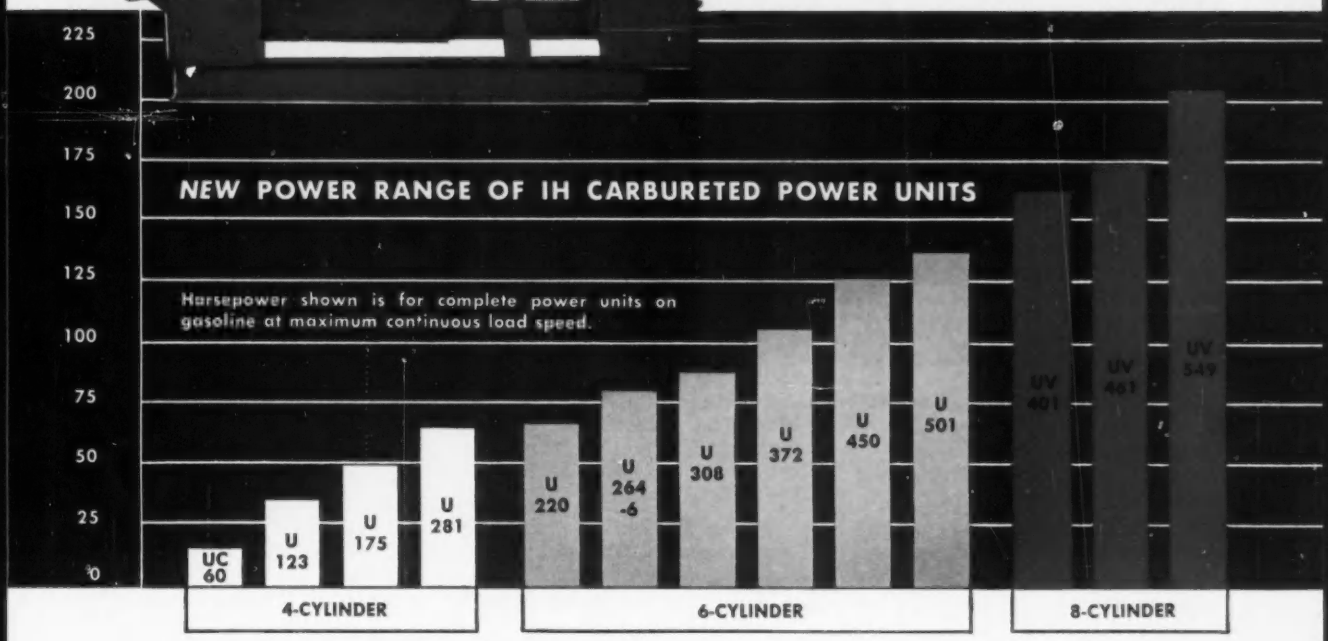
NEW V-8 UV-549 POWER UNIT. 208 net hp @ 2,600 rpm on gasoline, complete as shown. Not shown: UV-461 Power Unit—174 net hp @ 2,600 rpm, and the new UV-401 Power Unit—160 net hp @ 2,800 rpm.



These new models increase the International carbureted line to 13 models ranging from 16 to 208 hp on gasoline at continuous rated rpm, complete with regular accessories, fan and radiator. As stripped engines, they develop from 17 to 257 hp. LP-gas power is approximately the same as gasoline.

And just look at the standout V-8 features that help your customers cut operating costs: rigid, Y-shaped block; short-stroke, heavy-duty, cam-ground, 4-ring aluminum pistons; big, smooth-running, counterbalanced, tocco-hardened, 5-bearing crankshaft; large-area, long-life, tri-metal, replaceable bearings; combination full-flow, by-pass filter for long-life pressure lubrication; full-power, down-draft carburetion; oil cooler; and a 12-volt electrical system.

Our service to you will match the famous IH world-wide parts and service facilities that support these engines on the job—anywhere. Call in our experienced installation engineers or get pilot engine models for your research and testing before you specify. Your call or letter will get the special attention you need—fast.



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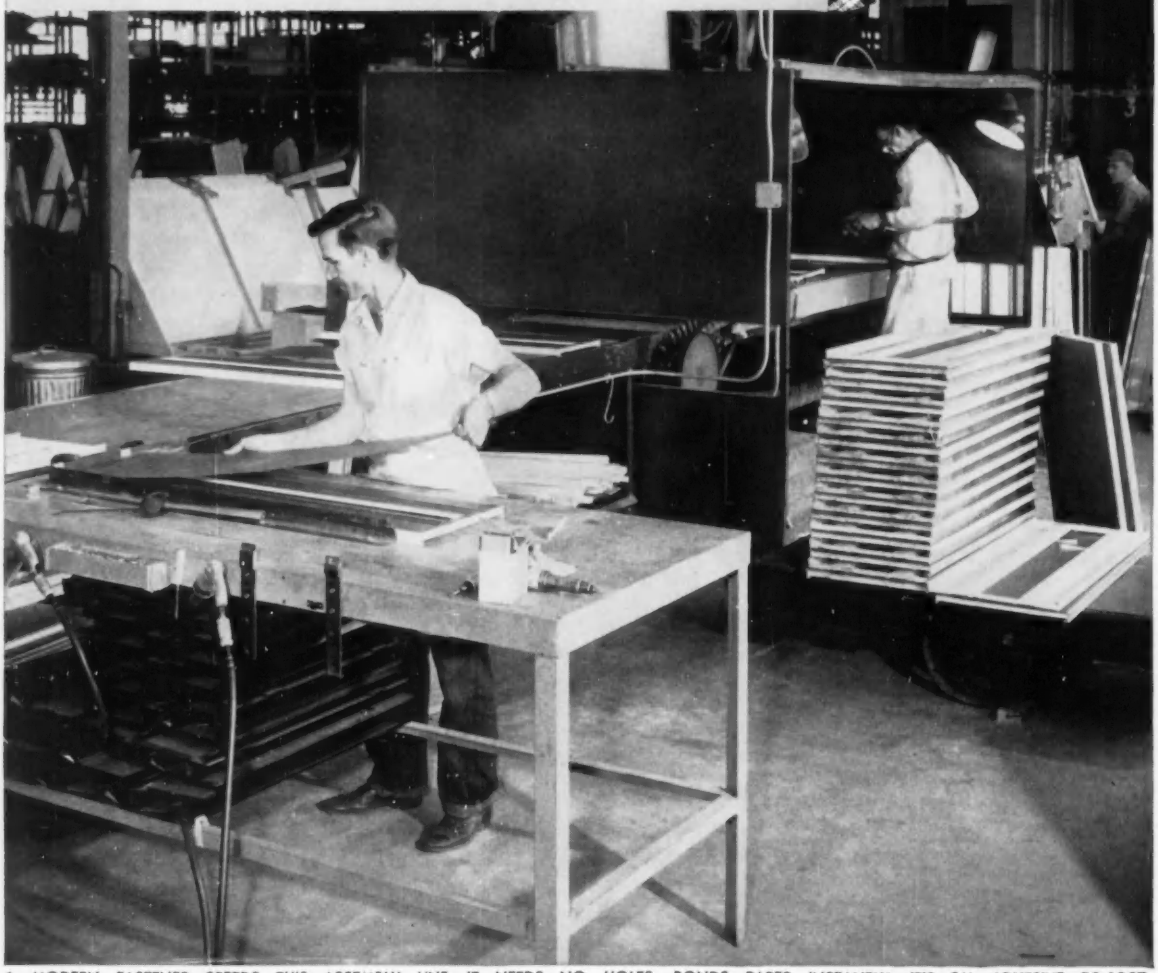

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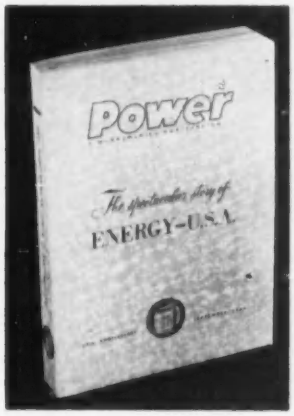


NEW LITERATURE

Power—75th Anniversary Issue

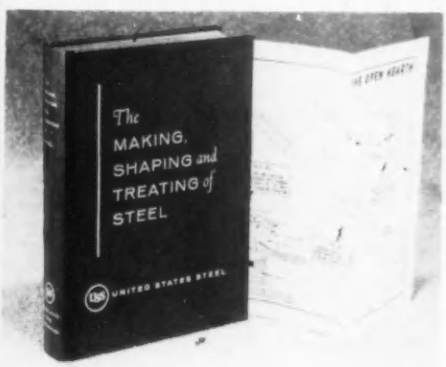
Published by McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 36. 8¼ x 11¼ in., 702 pp, $5.

This issue (Sept. 1957) demonstrates how *Power*'s 75-yr existence has spanned the period between the electrical revolution of the 1880's and the nuclear energy revolution of today. The issue is divided into four tabbed sections, each with its own index.

The first section describes the development of this country's power industry, from 1882 to today. Next, the present and immediate future of the power field is discussed in eight surveys on significant trends.

In the third section, the problems of satisfying the fast-increasing world power needs of the present and long-range future are considered. Some of the history of *Power* itself makes up the last section.

J.K.



Making, Shaping, Treating Steel

Published by S Steel Corp., 525 William Penn Place, Pittsburgh 30. 8¼ x 11 in., 1048 pp, $7.50.

Seventh edition of this single-volume reference to the entire iron and steel industry contains much of what even many experts need to know. In addition, it is a handy source of background information for the ferrous materials user. And for those who have never quite gotten over their first sight of a steel melt being poured, the 773 illustrations mean a special kind of leisure-time reading. Many fold-out flow diagrams of metal production and forming typical of the industry are included.

Recent developments reviewed include methods and equipment used in extrusion, and advances in pneumatic steelmaking processes. Steel scrap is the subject of a new section, and an expanded history of the beginnings of ferrous metallurgy both in this country and abroad is presented.

After a presentation of some of the fundamental principles of chemistry and physics, the book deals with refractories; iron ores; fluxes and slag; addition agents; steel scrap; early iron and steelmaking methods; modern blast furnace practices; modern pneumatic, open hearth, electric furnace, duplex and triplex steelmaking processes; steel and iron castings, including roll manufacture; heating methods; rolling treatment; mechanical testing and various types of gages. **J.K.**

Implications of Automation

Abstracted from "Some Economic Implications of Automation" by J. J. Brown, President, Industrial Automation Ltd., Montreal; Electrical Engineering, Oct. 1957.

What kinds of jobs could best be done by machines?

1. Machines should replace men wherever possible.

2. Men should not be used for routine operations, if machines can do the work.

3. The automaticity of men should be discouraged.

4. A corollary of the foregoing is that the automaticity of machines should be encouraged.

These principles are all very well as theory, but for them to have any impact requires some way of putting them into practice. Needed is a set of design principles geared to the goals outlined.

1. **Functionality.** Machines must be designed in terms of what they do, not in terms of what they make.

2. **Unitization.** Machines must be unitized by some method, preferably through the common denominator of electronics. These units should be put together temporarily in such a way that they make one product, and then, when assembled in a different way, make a different product.

3. **Adaptability.** Because both machine tools and electronic control units are expensive, it is better if they can make a variety of products.

Major roadblock in the road to advanced automation is man's basic hatred of change. Fundamental human conservatism, reinforced by the built-in financial conservatism of the business world, is a massive obstacle to all the kinds of rational production planning, automatic control of process, and automatic assembly, that are technically feasible today. The weapons we have for chipping away at this roadblock are education—always a long-term rather than a short-term process—and economic pressures.

IMPROVING PRODUCT DESIGN — Booklet PO-2157, 16 pp. Case histories detail how fabricators improved product design and performance with 17-4 ph and 17-7 ph stainless steel bar and wire. With description and properties of the stainless steels. Armco Steel Corp., Middletown, Ohio.

DATA AUTOMATION SYSTEM—Manual U-23, 79 pp. A complete guide to the Univac II system designed for computer specialist and layman. In five sections: available equipment and its function; nontechnical guide to binary numbers system and unit's seven-place code; technical description of central computer's functional organization; explanation of the system's list of instructions; and illustrations of response to special conditions. A two-page foldout diagram of system and peripheral equipment shows unit receiving and converting data. Remington Rand Univac, 315 4th Ave., New York 10.

COST REDUCTION—Booklet, 20 pp. A new approach to the price-per-1000 controversy. The evaluation is illustrated with charts, photos and sketches. Shakeproof, Div. Illinois Tool Works, St. Charles Rd., Elgin, Ill.

ELECTRONIC DEVELOPMENT — Booklet, 16 pp. Designed to examine factors that affect electronic development. Describes importance of research, engineering, facilities, quality control and reliability in electronic components and electronic products. Ampenol Electronics Corp., 1830 S. 54th Ave., Chicago 50.

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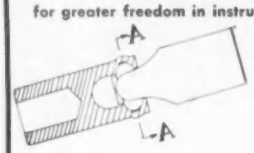

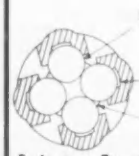

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4-6 **AIEE Machine Tool Conference,** 9th annual meeting, Hotel Schroeder, Milwaukee, Wisc. Sessions include reports on experience with stored intelligence control, recent developments in electric motors and advances in the art of control. For information contact the AIEE, 29 W. 39th St., NYC.

4-8 **SAE Conferences,** Hotel Statler, Cleveland, Ohio. The three National SAE meetings include Transportation, Nov. 4-6; Diesel Engine, Nov. 5-6; Fuels and Lubricants 7-8. For information contact the Society, 485 Lexington Ave., NYC.

11 **Plastics for Air-borne Electronics,** Regional Technical Conference of Society of Plastics Engineers at Ambassador Hotel, Los Angeles. For information contact L. J. Costanza, 8017 Holy Cross Place, Los Angeles.

12-14 **National Association of Corrosion Engineers,** Fall meeting, Northeast Region at Penn-Sheraton Hotel, Pittsburgh. For information contact A. B. Campbell, 1016 M & M Building, Houston, Texas.

13-15 **National Conference on Standards,** sponsored by American Standards Association at St. Francis Hotel, San Francisco. Program includes 11 sessions and more than 50 speakers discussing government and industrial use of standards, cost improvement through standardization and application of standardization to specific industries. For information contact Miss D. E. Denton, the ASA, 70 E. 45th St., NYC.

18-20 **National Industrial Conference Board,** Management course on industrial utilization of radioisotopes at Westchester Country Club, Rye, N. Y. The course, moderated by representatives of the AEC and Battelle Memorial Institute, will discuss industrial use of radioisotopes in nontechnical terms. For information contact the NICB, 460 Park Ave., NYC.

19-21 **Investment Casting Institute,** annual fall meeting, Sheraton Hotel, Chicago. Technical session, Nov. 19, will compare induction and carbon arc techniques of melting high alloy steels. Sessions, Nov 20, will cover business trends. For information contact the Institute, 27 E. Monroe St., Chicago.

DEC.

1-6 **ASME,** annual meeting Sheraton McAlpin and Statler Hotels, NYC. Schedules call for 12 to 15 simultaneous sessions to allow broad and specialized coverage of engineering developments. For information contact the Society, 29 W. 39th St. NYC.

2-6 **Exposition of the Chemical Industries,** at New York Coliseum. More than 500 exhibitors will display materials, laboratory equipment, process equipment. For information contact the Exposition, 480 Lexington Ave., NYC.

2-6 **International Automation Exposition,** Trade Show Building, New York City. For information contact Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh, Pa.

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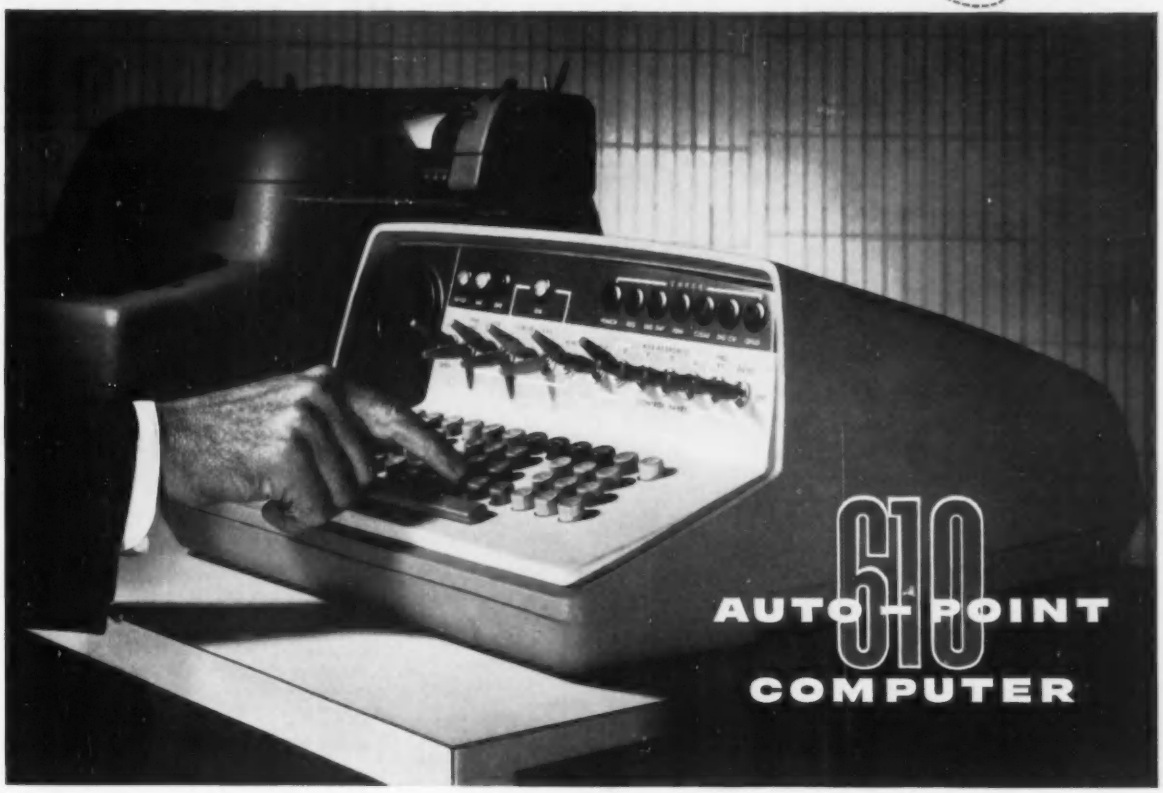

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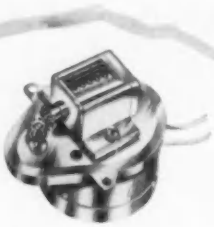
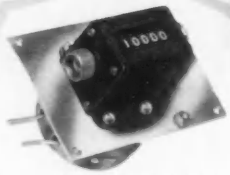


7500 Series DC Elapsed Time Indicator. Send for Bulletins: AWH ET600. Basic Elapsed Time Indicators 7500, 12500, 24200 Series.



7500 Series Reset Type Elapsed Time Indicator. Send for Bulletins: AWH ET601. Reset Type Elapsed Time Indicators 7500, 12500, 24200 Series.

Now the Company offers a complete line of timing motors and devices to record the operating time of any electrical or electronic equipment. Compact, minimum weight, each unit has five digits. They can be used to provide daily running time plus a total running record, eliminating estimating or manual totalizing. In both AC and DC, continuous or manual reset for 50 or 60 up to 400 cycle line frequency. Will measure hours or on down to 10ths of seconds. All models can be supplied with Radio Interference Filtering, to meet MIL-I-6181B.

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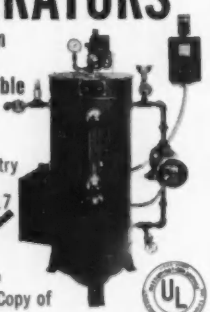

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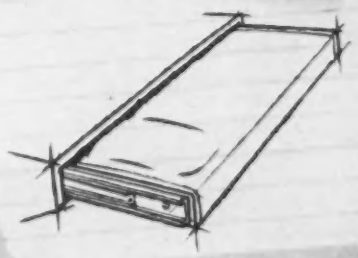

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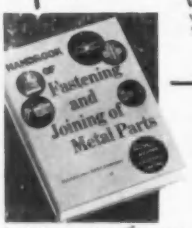

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Publisher's Postscript...

To Extend Your Eyes and Ears–

When you subscribe to a magazine, you do so because you expect to invest some of your time reading it. There are about 2,000 business, technical and trade publications in this country. Some are excellent–especially designed and edited to help the reader. Others are published principally for the benefit of the advertiser.

We all have to read to keep abreast of the new ideas or the new methods that are asserting themselves in our fast-moving economy. But how and what you read can make a big difference. Ask yourself the questions, "Am I investing my time reading publications that have the editorial competence and widespread sources of information to make me a better informed man on my job? Am I getting the most out of my reading time?" The size and experience of the editorial staff serving you can make a big difference in the amount of useful information you get.

We were tremendously impressed the other day when at a meeting we introduced the members of *Product Engineering's* enlarged editorial staff to our top management. We doubt that there is another editorial staff serving the design-engineering profession that even comes close to this one in terms of education, experience and practical know-how.

Product Engineering has a full-time staff of 43 people. Twenty-seven are editors—24 men, 3 women.

These 27 editors attended 42 colleges and universities.

They have 31 college degrees from B.S. to Ph. D.

They had 122 years of engineering and industrial experience in 33 different job functions and specialized in 24 different engineering assignments.

They had experience with 45 different companies.

Combined, they had 188 years of reporting and writing experience on 21 publications other than *Product Engineering*.

They hold membership in 25 different technical societies. Ten editors are members of six honorary engineering societies.

The work of the 27 editors, located in New York and throughout the country, is augmented by 7 McGraw-Hill domestic and 8 foreign news bureaus employing 55 full-time McGraw-Hill editors. In addition, the large McGraw-Hill Department of Economics staff regularly contributes to our columns.

This highly specialized group extend your eyes and ears throughout the entire field of product design and research and development to keep you better informed through their reports and articles. Engineers, like yourself, they are trained to bring you the kind of information you need—clearly—accurately—and concisely as possible.

The engineering executive or designer who wants to be well informed, will find more useful information in the columns of this magazine week after week than is available from any other source. —*A. H.*

READER TO EDITOR

Ups and Downs

To the Editor:

I notice in your Oct. 7 issue an item that begins, "Why Don't They Research and Develop individual elevator shafts for every floor of a tall building?" Thought it might be of interest to note that the Farben Building (used by our Occupation Forces) in Frankfurt, Germany, does have such an installation.

During a tour of duty in Germany in 1947-1948, I noticed the system used in this building. I would say it is quite an experience going up and down in these individual elevator shafts.

—Lt. Col William L. Drennen
Ordnance Corps. Detroit Arsenal

To the Editor:

In your "*Why Don't They Research and Develop?*" Oct. 7, you talked about a system of individual elevator shafts. These are well-known in Germany and have been in use there for at least 30 years. These elevators were known as *Paternosters*, apparently because their mode of operation caused a great many people to utter the Lord's Prayer for protection. I, myself, as a young boy, have traveled on these continuously moving platforms in some of the office buildings. As far as I can remember they are actuated by chains and, incidentally, travel sideways through the attic and basement, so that one series of platforms moves up, as the other descends, to provide continuous operation.

The passenger-to-be has to use fairly careful timing in order to board or leave the platform without accident, so this method is not too practical for older or sick people. The same reluctance has been experienced with moving stairs which, by and large, seem to have replaced the above system.

—Peter W. Meyer
Chief Engineer
West Warron, Mass.

Check the Industrial Designer

To the Editor:

Concerning "The Industrial Designer, Friend or Foe," (Oct. 7, p. 21) we believe the engineer leaves too much

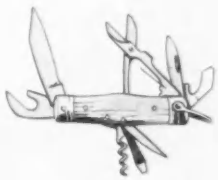
F.Y.I. (personal)

Batter-ies up

Want to please the youngsters, and get ideas for your own products, too? Take a look at today's battery-operated toys. There are miniature—but effective—drink-mixers and food mixers, vacuum cleaners and washing machines. Many of these are replicas of name brands. A washer-dryer combination, for instance, is modeled after a well-known commercial unit, and takes soap and water, washes, and spin-dries "just like the real thing." A sink-stove combination, also name-branded, lights up, but does not heat. Such units range in price from $3 to $8. But, if you want to invest as much as $14.95, there's a transistor-and-battery kit that makes a radio "or any one of eight other electronic devices"—including a voice-transmitter and a code-blinker—just by following the plug-ins on the templets provided.

Incidentally, there are plenty of new battery-operated gadgets you can use yourself—almost anything from barbecue spits to cigaret lighters can now be had with this convenient, portable source of power.

They cut—and then some



How many tools can you cram into a jack knife? The Swiss hit 30, years ago—but the knife was too heavy to carry. John Surrey, Ltd, 11 W. 32nd St., New York 1, is showing a collection that seems more practical. Its "Little Giant," 2¼ in. long, has two blades, pick, corkscrew, bottle opener, scissors, can opener and nail file. The "Paul Bunyan," 6½ in. long, has knife, fork and spoon, plus a saw, scissors, can opener, bottle opener, and cutting blade. The Little Giant is $2.45; the Paul Bunyan, $14.95 (postage included).

Hang on to those pennies

Does the Little Woman have an idea she's getting cheated at the grocery check-out counter, but no way to check up—not fast enough, anyway? Damar, Inc., 868 Damar Bldg., Elizabeth N. J., has just the answer: A dial calculator with adjustable hand strap. She just adds up purchases as she goes along. Each time she selects an item, she moves the dial and the unit adds the amount to the previous total. Price: $4.98.

The add-and-calculate field might seem like a crowded one. But this unit, and the new Golfer's Scorekeeper (Sept. 23, p. 57) prove there's plenty of room for more.

WHY DON'T THEY RESEARCH and DEVELOP. . .

. . . an antiaircraft shell that would place a large cloud of gas in the path of enemy flight. The gas might explode on contact with hot engine parts or exhaust, or (like a CO_2 bomb) it might stop combustion. Such a shell would have more staying power than the normal explosive shell and at present speeds few aircraft could turn fast enough to miss a cloud several hundred feet ahead.

—S. Hamilton, *Winnipeg, Man.*

. . . a traffic signal (one only, over the middle of the intersection where it is easy to find) equipped with radar or proximity pickup and counter to automatically adjust signal timing to traffic load and shut it off (or turn on caution lights) when it is not needed. It sure is a waste to stop when there is no other moving vehicle within blocks. It would save police time too.—Kenneth Kahn, *Yuma, Ariz.*

. . . a pair of binoculars based on the new light amplifier invented at RCA. Most dark landscapes have at least some sky or local lighting but visibility may be poor even with dark-adapted eyes. The unit increases illumination several hundred times—perfect for night travel.

. . . automobile brakes in which pedal depression calls for a fixed deceleration. An accelerometer would measure car speed changes and adjust brake pressure (probably hydraulically) to reduce speed at a constant rate. Full pedal depression would call for maximum deceleration; the controller would automatically call for greatest brake pressure possible without wheel lock. Max possible deceleration on icy roads would be considerably less than on asphalt but the controller would prevent skids in either case.

Have you a pet project but neither the time nor inclination to do the necessary R & D—Product Engineering will welcome (and identify the originator of) similar ideas based on known scientific principles but lacking an inspired manufacturer

to the industrial designer. I have a GE "Musaphonic" radio which should and does represent the ultimate in table models for sound reproduction. The controls are on a box extension which is decorated. But the outer brass ring, when raised, shrouds the scale and pointer. It should be flush.

Alas, for the person who assembled the scale and pointer. He never heard of parallax, or didn't believe in it; the pointer is so far in front of its scale that almost any reading can be bad, according to the viewpoint. This is a really serious oversight by the engineer: not checking up on the designer.

—Carl T. Nachod
V. P. Nachod & U. S. Signal Co., Inc.
Louisville, Ky.

Crane Control

To the Editor:

May I offer our answer to the crane-control problem, on page 50 of the Oct. 7 issue.

It isn't miniature, it isn't transistorized nor is it battery-operated, but it works and people buy them.

Here are several data sheets that will explain it.

—H. A. Blair
Femco, Inc., Irwin, Penna.

Ed.—*The data sheets describe a remote crane control operated by "high-speed synchronous relays on crane and floor panel" that are triggered by radio frequencies. The transmitter (located in the control panel) generates RF signals transmitted "directly over the 250-v dc or ac power lines. No additional wires or rails are necessary." The system is, of course, ingenious and probably quite reliable. It represents the first step toward the true operator freedom that would be possible with radio control.*

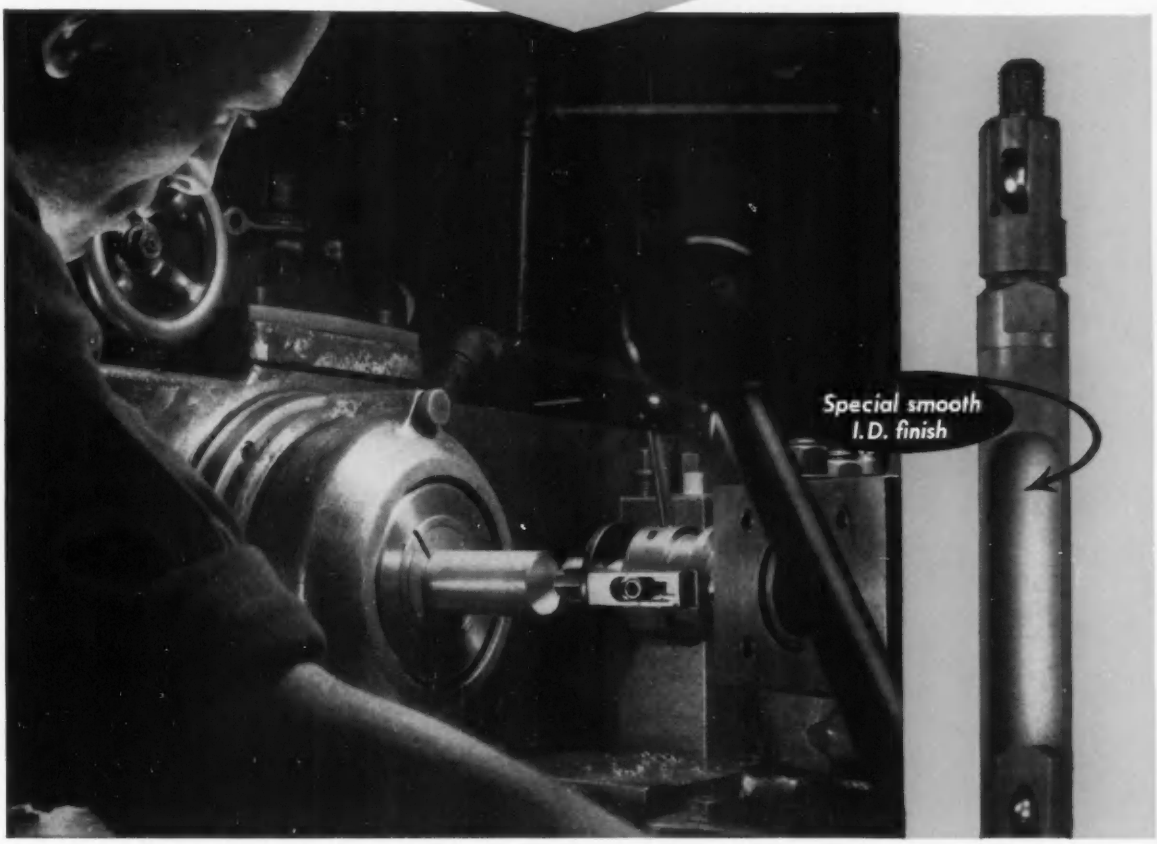
The Great Mail Robbery

To the Editor:

I am sorry to say that the July and August issues never arrived. I have tried to get them several times at the local post office, but without success. The local post office seems to think that *Product Engineering* and several other leading American publications are being stolen at the main post office at Buenos Aires. These, I have been told, are then sold at the local book stores. Isn't there anything that can be done about this situation?

—Vald Hanson
Tres Arroyos, Argentina

This pump manufacturer reports 25% savings with J&L COLD DRAWN ELECTRICWELD TUBING



Operator is threading 1¾" O.D. x 1½" I.D. J&L special smooth *cold drawn* Electricweld tubing for pump cylinder.

Low original cost and elimination of interior honing are two reasons why it pays you to specify J&L *cold drawn* Electricweld tubing with special smooth I.D. finish.

This manufacturer of oil well insert pumps reports a saving of 25% by converting from honed seamless tubing to *cold drawn* special smooth I.D. Electricweld tubing. Not a single tube failure has been reported from the field.

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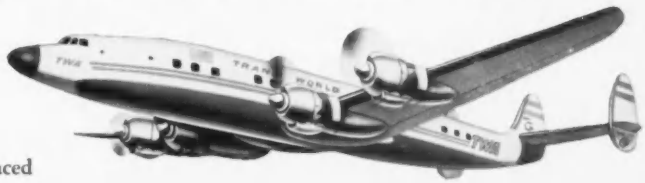

Increased demands for faster non-stop service has placed great demands on the engines that power modern airliners. Helping to meet this need is the powerful EA Series Turbo Compound engines built by the Wright Aeronautical Division of the Curtiss-Wright Corporation, Wood-Ridge, New Jersey. In each of these 18-cylinder giant engines, 3 GRAPHITAR oil seals play an important part in maintaining the dependability, efficiency and power. Three power-recovery units are employed on the Turbo Compound to utilize normally wasted exhaust gases and provide still additional thrust. The GRAPHITAR seals are used on the turbine shaft in each of these units and must withstand continuous high speeds and high temperatures. These seals prevent hot gases from reaching the shaft bearings and carbonizing the lubricant. Low coefficient of friction, and the excellent wear and sealing properties of GRAPHITAR make it ideally suited for this demanding installation.

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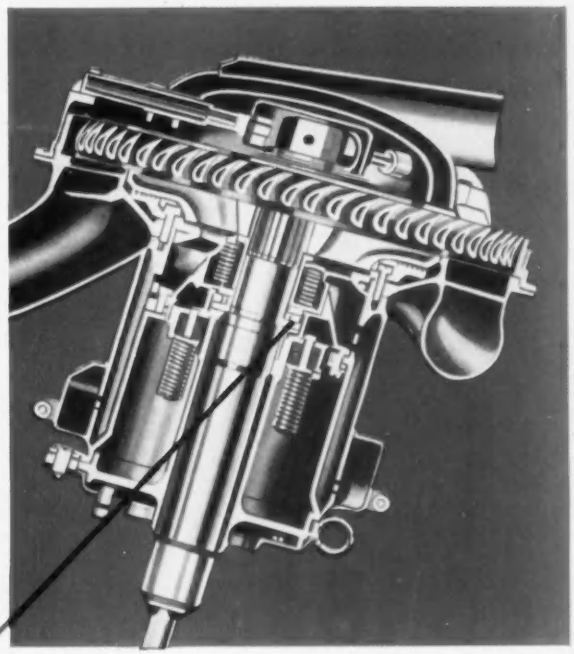

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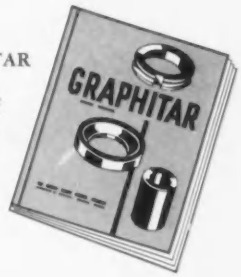

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